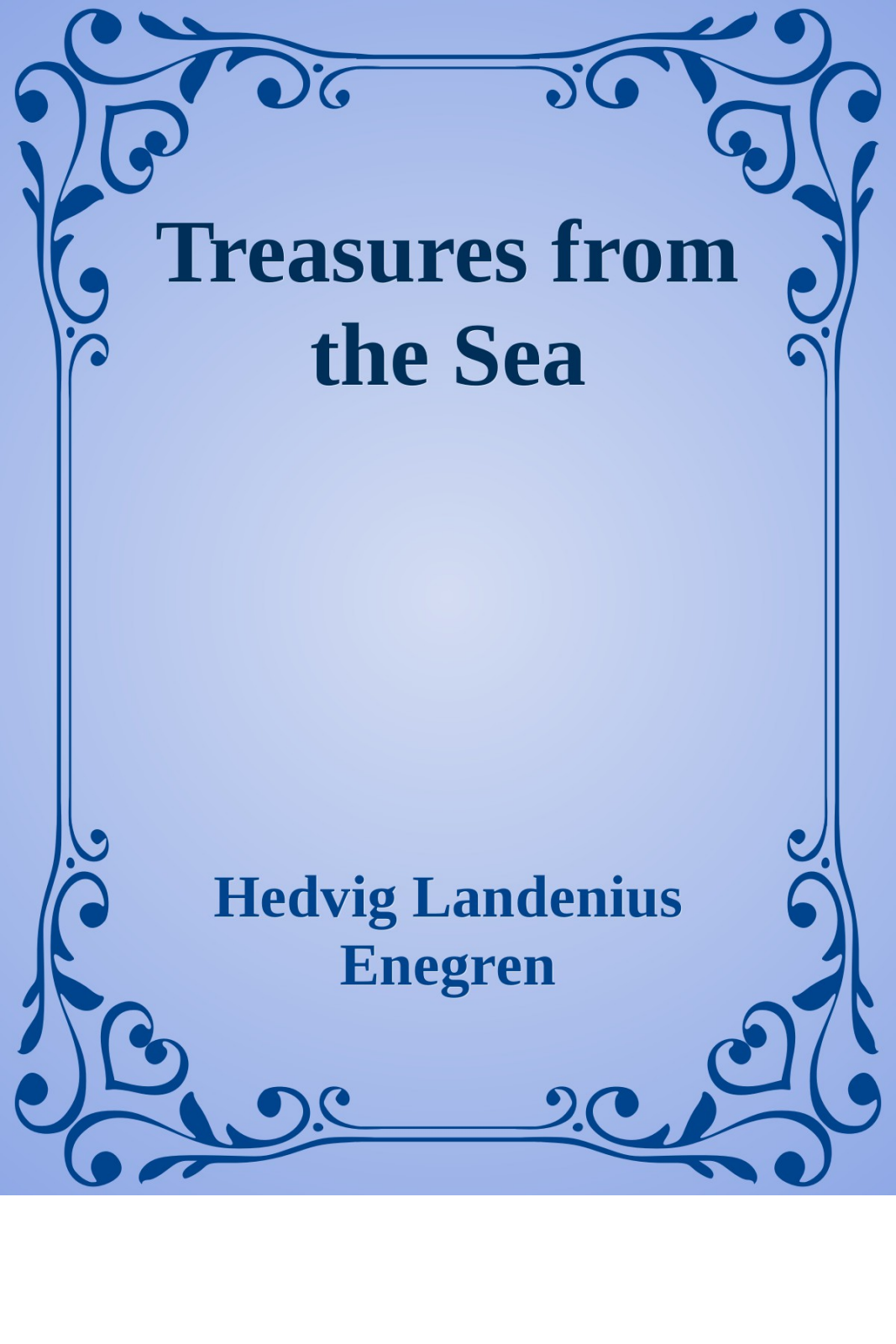


A decorative border with intricate floral and scrollwork patterns in a dark blue color, framing the central text.

Treasures from the Sea

**Hedvig Landenius
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TREASURES *from the* SEA

Sea Silk & Shellfish Purple Dye in Antiquity

EDITED BY HEDVIG LANDENIUS ENEGREN & FRANCESCO MELO



TREASURES FROM THE SEA
SEA SILK AND SHELLFISH PURPLE DYE IN ANTIQUITY



Frontispiece. Group photo of the participants at the Lecce workshop at the Museo Storico Città di Lecce (MUST)

ANCIENT TEXTILES SERIES 30

TREASURES FROM THE SEA

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Edited by

HEDVIG LANDENIUS ENEGREN AND FRANCESCO MEO

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Front cover: Top – Pinna nobilis, Pinna muricata and Pinna rudis from the Indian Ocean, the Atlantic and the Mediterranean Sea (detail). After Müsch I., Rust J. and Willmann R. (2015) Cabinet of Natural Curiosities. Albertus Seba. Cologne. Bottom – Apollo wearing a laurel or myrtle wreath, a white peplos and a red himation and sandals. Tondo of an Attic white-ground kylix. Archaeological Museum of Delphi,

Inv. 8140, room XII. After https://commons.wikimedia.org/wiki/File:Apollo_black_bird_AM_Delphi_8140.jpg?uselang=it#filelinks Back cover:
Hexaplex trunculus shell.

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Introduction

Hedvig Landenius Enegren and Francesco Meo

Background

In 2012 the Danish National Research Foundation's Centre for Textile Research (CTR) at the Saxo Institute, University of Copenhagen proposed to organise an international conference dedicated to two "Treasures from the Sea", shellfish purple dye and sea silk, within a Marie Curie Intra-European Fellowship held by Hedvig Landenius Enegren at CTR. At the time, Francesco Meo from the University of Salento, was a Visiting Scholar at CTR and suggested that this conference be held in Lecce, located in Apulia, the heel of Italy. Lecce, besides being centrally placed in the Mediterranean, is close to Taranto, which in antiquity was famous for its purple-dye production. Moreover, sea silk was worked, up until the 1950s, at Lecce in the orphanage of *Santa Filomena*,¹ now a building incorporated in the University of Salento. This made the beautiful city of Lecce the natural choice for the conference to take place. The scope of the conference was to merge theoretical and historical viewpoints of these two "treasures from the sea" with practical demonstrations in order to gain knowledge in how these marine resources are actually worked from scratch, their *chaîne opératoire*, so to speak.

This volume of the conference proceedings is composed of two sections. The first is dedicated to sea silk and the second to shellfish purple dye, while the contribution by Inge Boesken Kanold treats both purple dye and sea silk.

The first paper in section 1 by Felicitas Maeder gives a comprehensive view of the different terminological components involved with regard to sea silk. The author addresses linguistic problems due to the wrongful interpretation of the term byssus in ancient and more recent sources.

The following paper by Anne Sicken defines the microscopic components of sea silk, its morphology and the properties of the fibre. These are crucial to the identification of possible sea silk in archaeological contexts.

Alfredo Carannante and Elena Soriga discuss possible Near Eastern evidence for the use of sea silk already in the Bronze Age, based on cuneiform sources.

Sanne Houby-Nielsen argues from the archaeological evidence at the site of Haghia Triada in Chalkis, Greece, for the possibility that sea silk was worked there in a small-scale domestic context in the 7th century BC.

Francesco Meo analyses the evidence for the working of sea silk at the

ancient Greek *polis* of Taras, modern Taranto, in order to investigate the connection between sea silk and *Tarantinon*, a type of very lightweight robe, possibly made of sea silk.

The last paper in this section is based on an interview made by Felicitas Maeder with Assuntina and Giuseppina Pes of the small Sardinian island of Sant'Antioco describing the different stages of sea-silk manufacture, which they learned as children from Efisia Murroni. As the pen shell *Pinna Nobilis*, the source of sea silk, is a protected species since 1992, according to the EU Habitats Directive 92/43/EEC Annex IV 1992, the manufacture of sea silk today is virtually non-existent or at the least much reduced, as it depends on fishermen finding the shells in their nets or on the beaches.

The paper by Inge Boesken Kanold treats both sea silk and shellfish purple dye. It provides a discussion of her experimentation with the particular shellfish purple dye *Hexaplex Trunculus* applied to cotton, sea silk and wool. From Pliny's recipe she reconstructs the fermentation vat using fresh sea snails highlighting the importance of the two topics of the conference.

The second section of the conference proceedings treats different aspects of shellfish purple dye. Chris Cooksey discusses recent advances in the knowledge of the chemical properties of Tyrian purple dye in the Mediterranean area.

Elena Soriga presents the evidence for shellfish purple dye in Middle Bronze Age Syrian contexts as she goes through the sources for the working of this dye focusing on the term *tabarru*.

Christoph Kremer analyses the diffusion of purple dyeing in the Mediterranean as a transfer of technology deriving from the Eastern part of the Mediterranean area and on the role of Crete in this possible transmission.

Cecilie Brøns investigates the occurrence of the colour purple in Greek sanctuaries in the 2nd half of the 1st millennium BC, discussing the presence of purple-coloured garments in temple inventories.

The paper by Bianca Ferrara continues the preceding theme. She investigates the connection between the *peplophoria* and the use of purple-dyed garments providing an analysis of a series of sources – epigraphic, literary and archaeological – with reference to the Heraion at the mouth of the river Sele (Paestum).

Margarita Gleba, Ina Vanden Berghe and Luana Cenciaioli discuss an analysis of textiles discovered in Hellenistic burials of quarry workers at the site of Strozacaponi close to Perugia, Italy. The paper suggests that purple-dyed yarn was affordable within a wider frame of society.

Fabienne Meiers provides a historical outline of the purple dye referred to as *Rubra Tarantina*, extracted from the shellfish species *Bolinus Brandaris*, incorporating historical sources and chromatic properties.

Carmen Alfaro Giner and Francisco Javier Fernández Nieto give an overview

of the ancient sources relating to laws and treaties between Greek *poleis*, pertaining to fishing rights and the production of shellfish purple, demonstrating the highly organised mechanisms involved.

Finally, with Benedict J. Lowe's paper we enter into Roman Imperial times. The paper presents the epigraphic and literary sources for purple-dye workers, the *Purpurarii*.

Acknowledgements

We extend our sincere thanks to Professor Marie-Louise Nosch, Director of the Centre for Textile Research (CTR), Saxo Institute, University of Copenhagen and the CTR for proposing the topic of the conference and for sustaining all the financial support of the conference. We thank Professor Mario Lombardo of the Dipartimento dei Beni Culturali of the University of Salento, Lecce for his valuable help in the logistical organisation of the conference. We extend our thanks to Professor Lucio Calcagnile of CEDAD (Centro di Datazione e Diagnostica, University of Salento, Lecce) for making it possible to hold the conference in the beautiful building which houses the *Museo Storico della Città di Lecce*.

Our heartfelt thanks go to all the participants of the conference, both speakers and listeners, who with their input made it such a successful event.

We warmly thank Dr David Reese, Yale Peabody Museum of Natural History, for his invaluable help both as a member of the scientific committee together with the two editors, and for further help with suggestions to, and proofreading of, some of the manuscripts. We are also indebted to Clare Litt, editor-in-chief of Oxbow Books, for her kind assistance.

A special thank you to Dott.ssa Catia Bianco for the layout and graphic design of the conference program and for her help in the general organisation of the conference.

We are indeed indebted to the generous financial support given to us by Queen Margrethe and Prince Henrik's Foundation and Lillian and Dan Fink Foundation for the publication of the conference papers in this volume, for which we wish to express our sincere gratitude.

Hedvig Landenius Enegren and Francesco Meo

Lecce, 25.02.2016

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Fig. 1.1. Natural byssus fibre ready to be spun.



Fig. 1.2. Assuntina and Giuseppina Pes with Felicitas Maeder spinning byssus thread.



Fig. 1.3. Murex shells ready to be worked into purple dye.



Fig. 1.4. Inge Boesken-Kanold demonstrating the purple-dye extraction process.



Fig. 1.5. Hexaplex trunculus shell with the gland containing the purple colour.



Fig. 1.6. Different hues of purple-dyed yarn.

1Mastrocinque 1928, 8.

Byssus and sea silk: a linguistic problem with consequences

Felicitas Maeder

A Chinese sage once said, that the quality of our world depends on the fact that we find the right words for the right things. And that the calamity on earth mainly originates from the fact that we use the wrong words for given realities.¹

Byssus is one of those words. No calamity results from that fact, but out of curiosity I wanted to know more. As a textile term, it is deeply rooted in the realm of myths and legends – and this is also true for sea silk. Both of these terms tell a different story, and yet they are interconnected in a strange way. Byssus as a zoological term is not very old: only in the 16th century this name has been given to the fibre beard of various bivalve marine molluscs, in analogy to the antique textile called byssus – not vice versa. With its byssus the molluscs are attached to solid objects or anchored in the sand and on rocks. The fact that sea silk was made from the byssus of the fan shell led and still leads to many misinterpretations and false attributions. To clarify some of them is the aim of this work.²

Sea silk, until a few years ago, was not really an issue in textile research. Blümner speaks about that strange textile made of the fibre tufts of the *Pinna*, placing the fabrication at a late but not specified date.³ Schrader mentions the tufts of the *pinna maritima* among other textile materials of little importance, culturally and historically of lesser interest, and therefore also from the linguistic point of view not to be commented.⁴ Also Forbes mentions sea silk as an aside, in the last section of the chapter “Other fibres”: “Vestments were made ... even from the bundles of fibres from the pinna mussel of the eastern Mediterranean coast.”⁵

Daniel McKinley, an American biologist and science historian, published in 1998 the first comprehensive monograph *Pinna and her silken beard: A foray into historical misappropriations* – a very critical historical analysis with an extensive bibliography, a standard work. Unfortunately, this remarkable publication, outside of any main category of textile research, did not receive the attention it deserves.⁶

In the same year – and independently – at the Natural History Museum of Basel, Switzerland, the Project Sea silk was initiated and led in 2004 to the world’s first thematic exhibition, with more than 20 sea silk objects from European and American collections, and the first illustrated monograph.⁷

Further information about the biology of the fan shell and its byssus, about production and processing of sea silk, the current state of knowledge of its history over 2000 years, an inventory of all surviving textile objects till 1950 and an extensive bibliography are documented on the Project internet site www.muschelseide.ch (in English, German, and Italian).

What is sea silk?

Sea silk⁸ is a product of the fan shell (*Pinna nobilis* L.).⁹ With a length of up to 1 m and more it is the largest shellfish of the Mediterranean, where it is endemic. It is rooted in sandy places or in *Posidonia* weeds near the coast with a beard of very fine, strong filaments. The scientific name of these filaments is *byssus*. The populations of *Pinna nobilis* have been decimated since the 1950s due to overuse and degradation of their habitat. In 1992, the fan shell was therefore placed under protection in the European Union; the removal of the shell and the use of all its parts are prohibited.¹⁰

The byssus of the fan shell is a tuft of fine, tear-resistant protein fibres generated by the byssus gland in the foot of the mussel. Byssus fibres are up to 20 cm long and have a smooth surface; the diameter is 10–60 µm. The main characteristic is the elliptic cross-section without any structure, as it is not found in any other natural fibre. This byssus is the raw material for sea silk, known since antiquity: a silk like textile material, famous and highly appreciated for its natural iridescent brown-golden colour.¹¹ The process of making sea silk out of byssus is shown in an article in this book.¹² The oldest item that has survived is a cap knitted in pure sea silk. It was found in 1978 during excavations in a damp basement in Saint Denis near Paris, France and is dated to the 14th century. Half of the existing textile objects are knitted. In the 19th century, another type of processing was developed: the use of unspun byssus beards for fur-like objects (Fig. 2.1).

Byssus is – as explained – the scientific term for the filaments of bivalves, e.g. *Pinna nobilis*. However, byssus is also a textile term known from various classical texts and from the Bible. Much has been published about it by textile specialists, historians of antiquity and linguistic experts.¹³ Others do not even mention it.¹⁴ But still the question remains: Exactly which material was meant? Even the latest analysis of the Greek term βύσσος and its forms on papyri texts from the 3rd century BC to the 3rd century AD does not bring any clarification,¹⁵ and Blümner's comment of 1875, that the whole question would be a problem of comparative linguistic research, is still true.¹⁶

Etymology of the term byssus

The *Etymological Dictionary of Greek*¹⁷...

βύσσος [f.] “Byssos”, flax and the linen made of it (Emp.); later also referring to cotton and silk <LW Sem. >

. DER βύσσινος ‘made of β.’ (Hdt.); βύσσωμα ‘net from β.’ (AP; on the formation see πέπλωμα, etc., Chantraine 1933: 187).

. ETYM The word is supposed to have been borrowed by Greek from Eg. *w:d* ‘linen’ via Semitic (Hebr., Aram. *būs*; see E. Masson 1967: 20 ff.; Szemerényi *Gnomon* 43 (1971): 661).



Fig. 2.1. Muff made of Sea-silk from Taranto (Italy), 19th century. Chicago, Field Museum of Natural History, Inventory FMNH 2462 (MS Inventory 20).

... and the *Oxford English Dictionary*¹⁸ explain:

< Latin *byssus*, < Greek βύσσος ‘a fine yellowish flax, and the linen made from it, but in later writers taken for cotton, also silk, which was supposed to be a kind of cotton’ (Liddell & Scott), < Hebrew *būts*, applied to ‘the finest and most precious stuffs, as worn by kings, priests, and persons of high rank or honour’ (Gesenius), translated in Bible of 1611 ‘fine linen’, < root **būts*, Arabic *bād* to be white, to surpass in whiteness. Originally therefore a fibre or fabric distinguished for its whiteness.

Etymological and linguistic studies show that the Greek term βύσσος is connected to the Uigur term *böz*.

“Textiles made from cotton are designated in Mongol *būs* (Kalmuk *bös*), in Jurči (Jučen or Niüči) *busu*, in Manchu *boso*. These series, first of all, is traceable to Uigur *böz*. The entire group is manifestly connected, as already recognized by Schott, with Greek βύσσος, *byssos*, which itself goes back to Semitic (Hebrew *būš*, Assyrian *būšu*).”¹⁹

Róna-Tas discusses the meaning of *böz* in the Altaic world; the main focus lies on cotton.²⁰ Ecsedy defines *böz* as an exotic cloth gift at the Chinese Imperial

Court, probably cotton.²¹ Raschmann, in her linguistic study about cotton in Turkish central Asia demonstrates the various meanings of the term *böz* for cotton products.²² Thus the heavyweight lies on cotton, but there appears to be no consensus about the real material of *böz*.

A new aspect enters 1991 with Dalley discussing the Akkadian term *būṣu*, “Hebrew *būṣ*, Phoenician *bš*”. She explains in detail why this is about the “true byssus” – meant is sea silk: “Knowledge of true byssus appears to have fallen out of the focus of modern scholars of history; most recent works on ancient textiles only mention it in passing as a fine linen, although conchologists are still aware of its existence”.²³ In reality, she says, byssus is the “ultra-fine fabric woven from the tuft of fine silky filaments ... of the genus *Pinna* ...”. Unfortunately, Dalley refers to the incorrect entry to the term Byssus in *Drapery’s Dictionary* of 1882, and to faulty information, which are in the meantime clearly recognised as result of – still repeated – erroneous translations.²⁴ Her conclusion: “From Late Bronze Age and Early Iron Age sources it may be possible to show, both from representations and from texts that indicate the direction of trade, that Akkadian *būṣu* is indeed the fabric made of mollusc filaments.”²⁵

Such audacious statements have consequences. Villard refers in 2010 to Dalley when he writes about Neo-Assyrian textiles: “Le byssus, tissu très fin et de grande valeur, réalisé à partir de filaments produits par des mollusques, était réservé à quelques vêtements de luxe.”²⁶

Byssus in antiquity: Linen, cotton, silk – or sea silk?

For the use of the term *byssus* in antiquity we look at *A Dictionary of Greek and Roman Antiquities*:²⁷

BYSSUS (βύσσοϛ). It has been a subject of some dispute whether the byssus of the ancients was cotton or linen. Herodotus (2.86) says that the mummies were wrapped up in bandages of this material (σινδόνοϛ βυσσίνηϛ τελαμῶϛι; cf. 7.181), and an examination of mummy cloth with the microscope has shown it to be linen and not cotton cloth. Byssus in Herodotus therefore signified linen made from flax, and not cotton, which he calls tree-wool (ἐῤριον [Att. ἔριον] ἀπὸ ξύλου, 3.47, 106, 7.65). The robes of byssus mentioned by Aeschylus (Sept. c. Theb. 1039; Pers. 125) and Euripides (Eur. Ba. 821) we may take to have been linen. In the same way linen is meant when we are told that the limbs of Osiris were wrapped in byssina (Diod. 1.85), that the image of Isis was covered with a black linen garment (Plut. Is. et Osir. 39), and that the great ship of Ptolemy Philopator had a sail of byssus (Athen. 5.206 c). But in some writers byssus is erroneously used to signify cotton (τὴν δὲ βύσσοϛ φύεσθαι δένδρον φασι, Philostr. Vit. Apoll. 20), and Strabo even gives the name to silk, which he supposed to be a kind of cotton (τὰ Σηρικὰ, ἔκ τινων φλοιῶν ξαινομένηϛ βύσσου, Strab. xv. p.693). It seems in later writers to have

signified a fine and costly texture, made generally of linen, but perhaps in some cases of very fine cotton. Simaetha in Theocr. 2.73 goes sightseeing in a dress of byssus (βύσσοιο καλὸν σύροισα χιτῶνα); it is mentioned by Apuleius as a thin dress (“byssu tenui pertexta,” Met. 11.100.3); and it is spoken of in the Gospel of St. Luke (16.19) as part of the dress of a rich man (cf. Rev. 18.12). Pliny (19.21) speaks of it as a species of flax (linum), which served mulierum maxime deliciis, and was very expensive. The word comes from the Hebrew bûtz, and the Greeks probably got it through the Phoenicians. Pausanias (6.26.4) distinguishes byssus from hemp (καννάβις) and flax (λίνον), and in another passage (5.5.9) says that it was grown in Elis, being not inferior to that of the Hebrews in fineness, but not so yellow (ξανθή); and that the women in Patrae gained their livelihood by making headdresses (κεκρύφαλοι) and weaving cloth from it (7.21.7). Mr. Yates thinks that λίνον was the common flax, and that βύσσος was a finer variety, but the byssus in Elis may have been a species of cotton. (Yates, *Textrinum Antiq.*, p. 267) Yates’ *Textrinum Antiquorum* of 1843 is probably the most reliable voice in this matter. He refers to Forster’s *Liber singularis de bysso antiquorum* of 1776. In Book I on *animal* fibres, Yates speaks in chap. V about “the pinna of the ancients” with their “tuft of fibres”. Throughout the 8-page chapter there appears nowhere the term *byssus*! The term *byssus*, however, is found in Book II on fibres of *vegetable* origin. In the chapter on flax there is the §70 on byssus. The question is discussed as to whether it is linen or cotton – especially in relation to Egyptian mummy bandages, and in this chapter there is no word about a mollusk derived textile product!²⁸

Dalley is, of course, not the first to confuse *byssus* and sea silk.²⁹ Lombard discusses the use of sea silk in Arabic surrounding in Middle Ages – called *suf al-bahr*, “laine de mer” (sea-wool) – and adds, that this rare textile material was used since antiquity and would mean *butz* in Hebrew, *byssos* in Greek and *byssus* in Latin.³⁰ The *Universal Dictionary of Arts and Sciences* of 1753 gives a suggestive summary for the term *byssus*: “In reality, the ancients seem to have applied the name indifferently to any kind of matter that was spun and woven finer than wool”.³¹ From the aforementioned, we may recognise that, since the 18th century, our knowledge has not improved. In 2005, Quenouille inclines to see byssus as cotton or as a mixed textile; her article ends with the statement: “Therefore, I would like to propose to keep the Greek term ‘byssus’ without translating it.”³²

The term byssus in the Bible

“To discover the meaning of a specific textile term, a lexicon is a good place to start, but a bad place to end”.³³ I can – after years of browsing in innumerable lexica, reference books and etymological dictionaries, as well as in many Internet databases – only agree. The statements contradict each other, depending on the language, publication date, scope or subject orientation.

Against this background, I formulate the question differently: How are the two terms βύσσος (gr. Byssos) and *Byssus* (Latin) translated in modern languages? Have the translations changed over time? Can we deduce something?

An important source for the interpretation of the term *byssus* is the Bible, translated in hundreds of languages and widespread in different cultures.³⁴ On the basis of different verses of different chapters in the Old Testament I analysed how the term *byssus* was translated into English,³⁵ Italian,³⁶ French,³⁷ and German³⁸ in Bible editions from the 16th to the 21st century.

The sources of the Old Testament of Christian Bibles in most modern languages are generally the Septuagint, a pre-Christian Greek translation, and the Vulgate, a Latin translation going back to the 4th century AD, with several revisions up to the late Middle Ages. In the Vulgate we find the term *byssus* or its derivations more than 40 times. However, the Old Testament was originally written in Hebrew, only a few parts were written in Aramaic – but that is of little interest in connection with the term *byssus*.³⁹

Byssus in English translations of the Bible

In the original Hebrew text of the Old Testament we find two different terms for what was later translated into Latin as *byssus*: Būš (Bûtz), and Šeš.

<i>Old Testament Hebrew term</i>	<i>Biblia Sacra Nova Vulgata</i>	<i>Douay-Rheims 1582</i>	<i>King James 1611</i>	<i>Darby Version, 1890</i>	<i>New Revised Standard Version, 1989</i>
1 Chron. 4:21 Būš	<i>cognationes Domus operantium byssum</i>	the house of them that wrought fine linen	the house of them that wrought fine linen	the house of byssus - workers	the guild of linen workers
Gen. 41:42 Šeš	<i>vestitvique eum stola byssina</i>	he put upon him a robe of silk	and arrayed him in vestures of fine linen	and arrayed him in clothes of byssus	he arrayed him in garments of fine linen
Prov. 31:22 Šeš	<i>stragulam vestem fecit sibi byssus</i>	... clothing of tapestry; fine linen	her clothing is silk	her clothing is byssus	her clothing is fine linen
Ex. 28:42 Bād	<i>Facies eis et feminalia lineae</i>	Thou shalt make also linen breeches	And thou shalt make them linen breeches	And thou shalt make them linen trousers	You shall make for them linen undergarments
Ez. 44:18 Pištim	<i>Vittae lineae erunt in capitibus eorum</i>	They shall have linen mitres on their heads	They shall have linen bonnets upon their heads	They shall have linen tires upon their heads	They shall have linen turbans on their heads
1 Chron. 15:27 Būš Bād	<i>Porro David indutus pallio byssino ... — David autem indutus erat etiam ephod lineo</i>	And David was clothed with a robe of fine linen , ... and David also had on him an ephod of linen .	And David was clothed with a robe of fine linen , ... David also had upon him an ephod of linen .	And David was clothed with a robe of byssus , ... and David had upon him a linen ephod.	David was clothed with a robe of fine linen , ... and David wore a linen ephod.

We find in 1 Chron. 4:21 – for the Latin term *byssus* from the Hebrew term Būš – fine linen in the 16th and in the 17th century, *byssus* in the 19th and linen in the 20th century. For the attribute *byssina* from Šeš in Gen. 41:42 we find silk in the 16th, fine linen in the 17th, *byssus* in the 19th and again fine linen in the 20th century. The third example, Prov. 31:22, shows, that even in the same Bible edition the term *byssus* – from Šeš – is not always translated

with the same term: In the edition of 1582, *byssus* in Gen. 41:42 is translated with silk and becomes fine linen in Prov. 31:22. Only 30 years later, in 1611, it is the opposite: fine linen becomes silk, silk turns to fine linen. In each of the two later editions the translation is congruent: *byssus* in 1890, fine linen in 1899.⁴⁰

Beside Būš and Šeš, there are two other terms meaning linen in Biblical Hebrew: Bād and Pištim⁴¹. These two Hebrew terms were not translated into Latin with *byssus*, but with the term *linea*, linen.⁴² In most translations into English, from the 16th to 20th centuries, both Hebrew terms become linen, without further attribute.

Of special interest is 1 Chron. 15:27, where we find two textile terms in one verse: Būš – Latin *byssino*, and Bād – Latin *lineo*. Bād is always translated with linen. Būš is here translated through the centuries as in 1 Chron. 4:21: fine linen – with the exception in 1890, where it is *byssus*.

Old Testament Hebrew term	Biblia Sacra Nova Vulgata	Giovanni Diodati, Geneva, 1649	Antonio Martini, London, 1821	Riveduta 1927	C.E.I. 2008
1 Chron. 4:21 Būš	<i>cognationes Domus operantium byssum in domo Iuramenti</i>	e le famiglie della casa d'Asbea, laquale esercitava l'arte del bisso	e le casate di quelli, che lavorano il bisso nella casa del giuramento	la casa dove si lavora il bisso	e le famiglie dei lavoratori del bisso
Gen. 41:42 Šeš	<i>eius vestivitque eum stola byssina</i>	... e lo fece vestir di vestimenti di bisso	... e fece vestire di una veste di bisso , ...	lo fece vestire di abiti di lino fino	...lo rivesti di abiti di lino finissimo
Prov. 31:22 Šeš	<i>byssus et purpura indumentum eius.</i>	Fin lino , e porpora sono il suo vestire.	il suo abito è di bisso , e di porpora.	ha delle vesti di lino finissimo e di porpora.	delle coperte, di lino e di porpora sono le sue vesti.
Ex. 28:6 Bād	<i>et hyacintho ac purpura coccoque bis tincto et bysso retorta opere polymito</i>	di porpora, di scarlatto, e di fin lino ritorto; e di lavoro di disegno.	e di scarlatto a due tinte, e di bisso torto con lavoro di varj colori.	e di fin lino ritorto, lavorata artisticamente.	scarlatto e bisso ritorto, artisticamente lavorati.
Ez. 44:18 Pištim	<i>Vittae lineae erunt in capitibus eorum,</i>	Abbiamo in capo delle tiare line ,	Avranno alle loro teste le mitre di lino ,	Avranno in capo delle tiare di lino ,	Porteranno in capo turbanti di lino
1 Chron. 15:27 Būš Bād	<i>Porro David indutus pallio byssino ... David autem indutus erat etiam ephod lineo</i>	E Davide era ammantato d'un ammanto di bisso ; e Davide avea indosso un Efod di lino	Davide poi era vestito di una veste lunga di bisso , ... ma David aveva ancora un Ephod di lino .	Davide indossava un manto di lino fino , ... e Davide avea sul manto un efod di lino .	Davide indossava un manto di bisso , ...Davide aveva inoltre un efod di lino .

Byssus in Italian translations of the Bible

The Hebrew term Būš – *byssus* in Latin – is generally translated with the Italian term *bisso*. The translation of Šeš – also *byssus* in Latin – on the contrary, is arguable. In Gen. 41:42 it is *bisso* in the editions of 1649 and 1821, in 1927 it turns to *lino fino*, fine linen, and increases to *lino finissimo*, finest linen in 2008. The second example in Prov. 31:22 is *fin lino, bisso, lino finissimo* turning to simple *lino* in 2008. These two verses show that – like in English – even in the same Bible translation the term *byssus* from Šeš is not always translated alike. With the exception of 1821, where it is translated *bisso* in both verses, in the three other translations of 1649, 1927 and 2008 they are not congruent.

The two other Hebrew terms meaning linen, Bäd and Pištim, were both mostly translated with linen in English editions. In Italian it is different. In Ex. 28:6, Bäd – here not translated *linea*, but *byssus* in Latin – the translation *fin lino* or *bisso* alternates through the centuries. Pištim in Ez. 44:18 – *linea* in Latin – is always translated with *lino*, like in English.

In 1 Chron. 15:27, with two textile terms, Bäd – *lineo* – is always translated *lino*. And we see again, that the translation in all four versions are not congruent. Būš – *byssus* in Latin – on the contrary, is *bisso*, except in 1927, where it is *lino fino*, turning to *bisso* again in 2008.

Old Testament Hebrew term	Biblia Sacra Nova Vulgata	Bible de Genève, 1588	La Sainte Bible de David Martin, 1744	Darby Bible 1859	Bible Louis Segond 1910
1 Chron. 4:21 Būš	<i>cognationes Domus operantium byssum</i>	... les familles de la maison de l'ouvrage du fin lin	de l'ouvrage du fin lin , qui sont de la maison d'Absbéath.	les familles de la maison des ouvriers en byssus de la maison d'Ashbéa,	la maison où l'on travaille le byssus , de la maison d'Aschbéa,
Gen. 41:42 Šeš	<i>vestitivque eum stola byssina</i>	et le fit vestir d' habits de fin lin	et le fit vêtir d'habits de fin lin ,	...et il le revêtit de vêtements de byssus	il le revêtit d'habits de fin lin
Prov. 31:22 Šeš	<i>stragulam vestem fecit sibi byssus</i>	... le fin lin et l'escarlate est sa vesture	...le fin lin et l'écscarlate est ce dont elle s'habille.	...le fin coton et la pourpre sont ses vêtements.	Elle a des vêtements de fin lin et de pourpre.
Levit. 13:47 Pištim	<i>Si in veste lanea sive linea lepra fuerit</i>	... soit vestement de laine, ou vestement de lin .	... soit vêtement de laine, soit vêtement de lin ;	... en un vêtement de laine ou en un vêtement de lin ,	..., sur un vêtement de laine ou sur un vêtement de lin ,
2 Sam. 6:14 Bäd	<i>Porro David erat accinctus ephod lineo</i>	...et estoient ceint d'un ephod de lin	...; et il était ceint d'un Ephod de lin .	et David était ceint d'un éphod de lin .	...et il était ceint d'un éphod de lin .
1 Chron. 15:27 Būš Bäd	<i>Porro David indutus pallio byssino ... David autem indutus erat etiam ephod lineo</i>	...et David estoit vestu d'un roquet de fin lin ... et David avoit sur soi un Ephod de lin	Et David était vêtu d'un éphod de fin lin ; ... et David avait un éphod de lin .	Et David était vêtu d'une robe de byssus ... et David avait sur lui un éphod de lin .	David était revêtu d'un manteau de byssus ...; et David avait sur lui un éphod de lin .

Byssus in French translations of the Bible

In French Bible translations, *byssum* from Būš is *fin lin*, fine linen in 16th and 18th century, *byssus* in 19th and 20th century translations.⁴³ For the term Šeš, *byssus/byssina* in Latin, the translations are more variegated: *fin lin*, fine linen in 16th and 18th century, turning to *byssus* in Gen. 41:42 in 19th, and *fin lin* again in 20th century translations. In Prov. 31:22 enters in the 19th century for the first time the term cotton: *fin cotton*, turning again to *fin lin* in 20th century.⁴⁴ Pishtim and Bäd are always translated *lin*, linen, without exception. In 1 Chron. 15:27 with the two textile terms, the translation of Būš is congruent with 1 Chron. 4:21, and Bäd is congruent with 2 Sam. 6:14.

Hebrew	Būš	Šeš	Bād	Pištim
Vulgate Latin	byssus (serico)	byssus	linea (byssus)	linea
English	linen	fine linen	linen	linen
	byssus	byssus		
	silk	silk		
Italian	bisso	bisso	lino	lino
	lino fino	lino fino	bisso	
	lino bianco	lino finissimo		
French	byssus	byssus	lin	lin
	fin lin	fin lin		
		fin coton		
German	Leinen	weisse Seide	(weisse) Seide	Leinwand
	Byssus	Byssus (= feinste weisse Baumwolle)	Leinwand	Byssus
	Leinwand	köstliche Leinwand	Byssus	Baumwolle
	Baumwolle	gele (gelbe) Seide	weisse Baumwolle	

Hebrew linen terms translated in Latin, English, Italian, French and German in Bible versions from 16th to 21st century

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We have seen, that the four terms for linen in Biblical Hebrew are mostly translated into Latin with only two terms: *byssus* for Būš and Šeš, and *linea* for Bād and Pištim. The greatest variety of translations is found for Būš and Šeš, this in English, Italian and French. Bād and Pištim are more uniform: linen, seldom byssus.

The greatest diversity of translations is found in German Bible editions, also from 16th century onward.⁴⁶ All four Hebrew linen terms have four different translations – without any congruence. In 1871, Būš and Šeš are for the first time translated *Byssus*, Šeš once followed by the comment, in brackets: *feinste weisse Baumwolle* (finest white cotton). *Baumwolle* – cotton – is found for all four Hebrew terms. Šeš is sometimes translated *weisse oder gelbe*⁴⁷ *Seide* – white⁴⁸ or yellow silk, and *köstliche Leinwand* – fine or exquisite linen. Even for the two Hebrew terms Bād and Pištim, translated in English, Italian and French mostly with linen, rarely with byssus, we find in German four different translations: linen, silk, cotton and byssus; silk and cotton sometimes with the attribute white.

Cotton appears also in French Bibles, already in 1859 for Šeš. In the same Bible, we find for the first time the term byssus for Būš and for Šeš; the same happens in the English Bible of 1890. Silk for Šeš is first seen in the English Bible of 1582.

In Italian Bibles, byssus is through the centuries very often translated with bisso. Bisso in Italy today is a fine textile for embroideries.⁴⁹ Unfortunately, bisso is used – ambiguously – also for sea silk.

New translations in Bible versions from the 18th century onward could point to a more historically-critical method the Septuagint and the Vulgate were studied, considering new research based on the original texts in Hebrew and Greek. It is noticeable, that between the second half of the 19th and the first half of 20th century, we find in all languages the most changes of translations of the linen terms Būš and Šeš – often turning in later translations back to terms

used in earlier Bible versions. This certainly is a point worthy to be looked at more in-depth.

This paper does not have the aim to define what was exactly meant with the term *byssus* in the Bible. However, with this synopsis, I – without claiming to be a philologist – only want to superficially demonstrate how manifold the interpretation of the term *byssus* were and remain through time and languages. It seems as if every generation of Bible translators had their own concept of the term *byssus*.

What I take as certain is, that the term *byssus* in the Bible never meant sea silk.⁵⁰ This opinion is confirmed by Jewish Bible experts, who cannot see sea silk in any of the many Hebrew linen terms.⁵¹

Byssus and sea silk: the pretended role of Aristotle

If we search the reason for all this confusion and misunderstanding around the concept of *byssus*, we come almost certainly to Aristotle. He would have been the first to give the name *byssus* to the fibres of the *Pinna*, so it is said. Was it the fault of Diderot's Encyclopaedia of 1751? The entry for BISSUS explains: "Aristote qui les [the fibres of the fan shell] nomme bissus, ou soie, des coquilles qui les portent".⁵² Fabbroni stated: "Aristotile chiamò Bisso il filo lucido con cui questa Conchiglia si fissa sugli scogli".⁵³ Later, Aristotle not only became the eponym of *byssus* beard for mussels, but also of its use as a textile material. Bezon summarises 2000 years of sea silk history in breath-taking concision: "Aristote nomme byssus la soie des pinnes marines, dont on a fait des bas, des gants et autres ouvrages ...".⁵⁴ In *Draper's Dictionary* of 1882, finally, we find for the term BYSSUS: "This manufacture was well known to the ancients, and is mentioned by Pliny and Aristotle."⁵⁵ Aristotle as "father of sea silk" became so a well spread topos till nowadays, repeated by many authors writing about sea silk⁵⁶. What happened?

This false attribution is based on a translation error, or more precisely an accent error going back to the 15th century, a very momentous error – at least for the history of sea silk. Müller pointed to this already in 1837,⁵⁷ but it was van der Feen, a biologist at the Zoological Museum Amsterdam (today Naturalis), who debunked this fault in an accurate semantic analysis, published 1949 in *Basteria*, the Journal of the Netherlands Malacological Society. The article has the simple title "Byssus" – the following is based on this short but important paper.

In the 4th century BC, the Greek philosopher Aristotle wrote an *Historia animalium*. In Book V 15 he described the fan shell *Pinna*: "Αἱ δὲ πινναὶ ὀρθαί φθονταὶ ἐκ τοῦ βύσσου ἐν τοῖς ἀμμώδεσι καὶ βορβώδεσιν". In the 13th century, Willem van Moerbeke (c. 1215–1286), a Flemish Dominican priest, translated the book into Latin: "*Pinnae rectae nascuntur ex fundo in arenosis...*" ("the *Pinna*-mussels grow upright out of the depth in sandy places ..."). This is

correct, as ὁ βύσσος is masculine, with accent on the last syllable – it means depth. Aristotle was a good observer, he remarked the fibres anchoring the *Pinna* on the ground, and wrote in the same chapter, some phrases later: “Of those that keep to one spot the pinnae are rooted to the ground”. So it is clear, that he did not use the term byssus for the filaments of the *Pinna*.

Two hundred years later, in the second half of the 15th century, Theodorus Gaza (c. 1400–1475), a Byzantine humanist living in Italy, made another translation of Aristotle’s *History of Animals*. He made major alterations, as he was convinced, that: “a translator of Aristotle must first do his best to restore the text to the form the philosopher had originally given it, and to do so he will have to make substantial changes *ad mentem Aristotelis*”.⁵⁸ Make a better Aristotle, one could say. Gaza was not always lucky in that, at least not in the translation of this special text concerning the biology of *Pinna*. He translated: “Pinnae erectae locis arenosis coenosisque ex bysso ...”. As in the time of Aristotle Greek was not written with accents,⁵⁹ he misunderstood the term “ἐκ τοῦ βύσσου” and translated “*ex bysso*”: “the *Pinna*-mussels grow upright *from the byssus*...” – ἡ βύσσος, feminine, with accent on the first syllable, meaning fine linen – as we know it now from the Bible.

That is how the term byssus for the fibre beard of the *Pinna* was born. Gaza’s version was much more successful. Printed in 1476 in Venice, his book had, by the end of the 16th century, already more than 40 editions.⁶⁰ “Gaza, in fact, had a ‘virtual monopoly’ on the biological works of Aristotle”,⁶¹ and more: “Immediately after its publication Gaza’s translation of *De Animalibus* achieved an authoritative status, totally eclipsing all previous translations”⁶² – although the incorrect translation of this cited phrase was contradicted later by many philologist and zoologist.⁶³

Nevertheless, the term byssus entered in zoology and was given later to all other bivalve filaments. So, from that moment on, to the already ambiguous term byssus known from the ancients – cotton? linen? silk? – was added one more: the zoological term byssus for the fibres of bivalves. But, following van der Feen: “... we must bear in mind, that not one author before Gaza, 1476, has ever used the word byssus in this sense [as fibre beard of the *Pinna nobilis*] and that all later use goes back to the quoted passage of Gaza”.⁶⁴

Byssus terrenus est et marina

Gaza’s vocabulary had a great impact on the biologists of the Renaissance.⁶⁵ The French naturalist Guillaume Rondelet (1507–1566) was one of his adherents. So it is not surprising, that he supported Aristotle’s pretended role in the naming of the fibres of bivalves. In 1555 his book *Universae aquatiliū historiae* is published in Latin.⁶⁶ He uses as first the term byssus for the filaments of the fan shell *Pinna nobilis* and explains carefully the different kinds of byssus, which serves, as he writes, to understand better some quotations in

the Old Testament and in profane authors. “Byssus terrenus est et marina”, there are two kinds of byssus: one of the land and one of the sea.⁶⁷ The land byssus he divides again into four different kinds:

- Asbestinum which doesn't take fire, as he remarks ⁶⁸, the most exquisite worldwide ⁶⁹
- Byssin from Elide in Achaie, for the delight of women ⁷⁰
- Byssina of Greece and Judea, resplendent like gold ⁷¹
- Bysse, a kind of linen in India, growing on a tree ⁷²

And then at least: the byssus of the sea, of the *Pinna*, like a soft and delicate brown silk named so for the resemblance to the byssus of the land of Greece and Judea.⁷³ That means: there is a sea byssus – sea silk – resembling the land byssus called Byssina – of linen. In other words, the fibre beard of the *Pinna* is called byssus as it resembles the well known old byssus, of linen. And not vice versa.

In 1786, Rosa follows in his theses Rondelet's words, writing of the shining and most precious byssus of different kinds and beauties, from the land and from the sea.⁷⁴

The result of all this interpretations is seen in the *Oxford English Dictionary* for the term byssus:⁷⁵

1. An exceedingly fine and valuable textile fibre and fabric known to the ancients; apparently the word was used, or misused, of various substances, linen, cotton, and silk, but it denoted properly (as shown by recent microscopic examination of mummy-cloths, which according to Herodotus were made of βύσσοις) a kind of flax, and hence is appropriately translated in the English Bible “fine linen”.
2. Zool. The tuft of fine silky filaments by which molluscs of the genus *Pinna* and various mussels attach themselves to the surface of rocks; it is secreted by the byssus-gland in the foot.

The main conclusion is: In antiquity byssus was a fine textile fibre of linen, cotton or silk. In the 16th century the filament of bivalves like *Pinna*, Blue mussel and others was given the name byssus, in analogy of the ancient byssus. That is the reason why, suddenly, textiles called byssus in antique texts became, in popular wisdom and for some authors, sea silk. With the simple logic: byssus is the name of the fibres of the *Pinna*, of which was made sea silk, byssus is found in the Bible and in profane antique literature, so byssus is sea silk.

Let's make it clear: Byssus before 1500 has nothing to do with the fibres of a shell, and so nothing with sea silk. Only from 17th century onward a textile called byssus may – perhaps – be sea silk.

Sea silk is a fact

However, sea silk existed! “From these filaments, textiles can be obtained, they

are mentioned in Greek texts from the 2nd cent. AD; but they are never called ‘byssus’.”⁷⁶ The golden shimmering sea silk, made of the filaments of the fan shell, was well known as a textile material of highest quality, very rare, very expensive. But it was never called Byssus! The oldest surviving textile item, a plain-knitted cap dating to the 14th century, found in Saint Denis near Paris, has already been mentioned. It is not known who owned this cap nor where it was manufactured. Maybe in Florence? In a Florentine trade directory of 1442 listing custom wages are mentioned *Beretti di lana di pesce*, caps made of fish wool.⁷⁷

Synonyms and translations for sea silk in English, Italian, French and German from 15th to 20th century

Fish wool was one of the terms given to sea silk, as seen above. The list shows the common terms for sea silk in German (*Muschelseide*), French (*soie marine*), Italian (*bisso marino*) and English (sea silk) and some different translations found in modern texts and books of the last 500 years. As from the 16th century onward the term byssus was also given to the filament of the *Pinna nobilis*, and from this filament was made sea silk, sea silk becomes byssus (Byssus and its derivates printed in fat font) in different languages – and so the chaos in textile terminology was perfect.

English	Italian	French	German
Sea silk	Bisso marino	Soie marine	Muschelseide
marine byssus	bisso	soie de mer	Byssus
byssus silk	seta di mare	soie de pinne	Byssusseide
pinna silk	seta marina	soie de byssus	Seeseide
marine wool	lana marina	laine de mer	Fischseide
sea wool	lanapinna	laine marine	Steckmuschelseide
fish wool	lana pena	laine de pinne	Meeresseide
	lanapesce	bysse	Pinnamarina-Seide
silkworm of the sea	lana di nacchera	byssus de pinne marine	Seewolle
	pelo d’astura	poil de nacre	Fischwolle
			Meerwolle
C.I.E.T.A.: Pinna, sea silk, sea-wool	C.I.E.T.A.: seta della conchiglia	C.I.E.T.A.: soie de coquillage	

In the 1970s, the *Centre International d’Etudes des Textiles Anciens* C.I.E.T.A. in Lyon published a textile vocabulary in different languages. How did they solve the problem? The C.I.E.T.A. proposals for sea silk are not convincing. For neither in original sources nor in research literature the terms *soie de coquillage* or *seta della conchiglia* – meaning sea silk – has ever been found. As the German term *Muschelseide* was known already in the 18th century,⁷⁸ these C.I.E.T.A. terms were probably mere literal translations from this German term.

Sea silk in Antiquity: written evidences

“Nowhere in Classical literature the Latin word ‘byssus’ or one of the two Greek words ‘βυσσός’ (masculine) or βύσσος (feminine) is used in connection with

any Molluscs.”⁷⁹ This is confirmed by my own studies in the last years. Byssus before 1500 does not mean sea silk. As it existed: how was it named? It was paraphrased, as we see in some early written statements.

The first written evidence of sea silk production is from around 200 AD. Tertullian, a church father from Carthage, living in Rome, denounced in *De Pallio III*, 6 luxury clothing with the following words: “*Nec fuit satis tunicam pangere et serere, ni etiam piscari vestitum contigisset: nam et de mari vellera, quo mucosae lanusitatis plautiores conchae comant.*”⁸⁰ No doubt: he spoke of sea silk, used as a textile fibre like wool and linen.

“How can the pinna produce her fleece of gold, which no dye has ever imitated?” This is how in the 4th century Basil the Great, Bishop of Caesarea in Cappadocia, in central Turkey, spoke of sea silk.⁸¹ I am quite convinced that this is the origin of the legend – just one of many – that the Golden Fleece of Jason in Greek mythology was made of sea silk.⁸²

Two hundred years later we find another statement. The Byzantine historian Procopius described cloth insignia which were given from the Roman Emperor Justinian to five satraps of Armenia, as sign of their power: “It is worthwhile to describe these insignia, for they will never again be seen by man. There is a cloak made of wool, not such as is produced by sheep, but gathered from the sea. Pinnos the creature is called on which this wool grows.”⁸³ The word Pinnos is explained: “A bivalve which grows a silky beard. The usual form of the word is πίννα.”

From these three statements we learn, that the knowledge of sea silk must have been quite widespread, from Rome over the Byzantine court till the centre of Asia Minor. But we should not forget that sea silk probably was always produced only on a small scale, and merchandised or given as gifts only by highest levels of society. I agree with Marzano: “Sea silk ... must have been produced in such small quantities as to make it an expensive and rare item, available only to the richest in society.”⁸⁴

As already stated, byssus in the Old Testament never meant sea silk. However, it was well known in the Jewish environment, as new studies show. In 2013 was published – for the moment only in Hebrew – a new formulation of Maimonides’ Mishneh Torah, the basis of the Talmud: “Sea silk [...] was available both in the Land of Israel falling in the Mishnaic period (ca. 225 CE) and in Egypt in the Maimonides’ period (about 1200 CE)”.⁸⁵

Sea silk in Late Antiquity: material evidence

Only one material evidence of sea silk production in antiquity has been found, to date, in Aquincum – modern Budapest – the capital of the Roman province Pannonia Inferior. The town was founded by Roman legionaries in the 1st century AD. The political importance of the boarder town may behown by the fact that almost all Roman Emperors visited the town once or several times

during their reigns. The fragment was found in an untouched female grave. The mummy was enveloped with 8–10 layers of resinated linen. Between the legs of the body remains of a brownish fabric were found. The fabric is described as coarse, the fibres as brittle, undulated, degrading, breaking easily and looking like a fabric made of hair. The diameter of the fibres was 24–32 μm , the cross section showed a compressed ellipse. Hollendonner, who analysed the fragment, compared the fibres with byssus of *Pinna nobilis* and found a perfect match: It was identified as sea silk, dated 4th century AD. His paper ends: “The textile of Aquincum is valuable not only for his Roman origin, but for his substance, for it is – as I think – the first time that remains of clothing made of sea silk have been found.”⁸⁶ Unfortunately, this fragment and the excavation records were lost during World War II. Even though it remains, up to the moment, the only material evidence of the production of sea silk in antiquity.

Summary

Byssus and sea silk are both terms rooted in mythology. Their history is interconnected and gives room for many interpretation problems and misunderstandings. Sea silk is a product of the fibre beard of the Mediterranean fan shell (*Pinna nobilis*). Since antiquity this rare, fine, golden shimmering fibre has been processed into small textile items. The oldest surviving object is a knitted cap dated to the 14th century.

Byssus is an often used textile term in the Bible. The manifold translations in different languages show the difficulty in knowing the exact meaning of the term. In the Bible and in other ancient texts it is discussed as a fine textile material of unknown origin: cotton? linen? silk? Aristotle was meant to be the first to have given the term byssus to the fibres of the fan shell, and so byssus in antiquity would also have the meaning of sea silk. A study dating to 1949 has shown that the reason for this opinion was an erroneous translation of Aristotle’s original Greek text. The conclusion is, that the term byssus was given to the filaments of bivalve shells in analogy to the byssus of antiquity, not vice versa.

But sea silk existed. There are different written statements that show the evidence of the knowledge of sea silk in Late Antiquity. From 4th century AD dates also a fragment of sea silk from a woman’s grave in Aquincum/Budapest. It was lost during World War II.

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1Es soll einmal einen chinesischen Weisen gegeben haben, “der die Qualität unserer Welt davon abhängig machte, ob wir für die rechten Dinge die richtigen Wörter finden. Dieser Weise war nämlich der Ansicht, dass das Unglück auf Erden vor allem daher stammt, dass wir für gegebene Realitäten die falschen Wörter benützen.” (Iso Camartin, NZZ vom 4.3.2002, translation by the author).

2This paper is based on my keynote lecture at the International Workshop “Treasures from the sea – Sea-silk and Shell purple dye in antiquity” in Lecce, Italy (26–28 May 2013). It is an extended version of my presentation in German at the International Conference “*Weben und Gewebe in der Antike. Materialität – Repräsentation – Episteme – Metapoetik*”, organised by the Departement of Classical and Ancient studies at the University of Basel, Switzerland (30.8.–1.9.2012): see Maeder 2015.

3Blümner 1875, vol. 1, 193: “*Ganz eigenthümlich ist die Fabrication von Stoffen aus den Faserbüscheln einer noch heut im mittelländischen Meere heimischen Muschel, der pinna. Auch diese Fabrication ist sehr späten Datums.*”

4Schrader 1886, Erster Teil: II. Die Gewebestoffe, p. 216: “... desgl. aus den Faserbüscheln der *pinna maritima* (vgl. Yates *Textrinum antiquorum* p. 145–159) habe ich, wie sie kulturhistorisch von geringerem Interesse sind, auch vom linguistischen Standpunkt nichts zu bemerken.” However, in the analysis of the term byssus he mentions repeatedly the silk like secretion of the *pinna maritima*.

5Forbes 1956, vol. 4, 63. More information: Yates 1843; De Simone 1867; Karabacek 1882; Laufer 1915; Basso-Arnoux 1916; Mastrocinque 1928; Brühl 1938; Villani 1947; Zanetti 1964; Wild 1970; Vial 1983; Sagot-Ortega 1992; Sroka 1995; Carta Mantiglia 1997; McKinley 1998; Maeder and Halbeisen 2001; 2002; Maeder 2008; 2009; 2010; 2012; 2015; 2016; Maeder *et al.* 2004; Strippoli 2005.

6One reason may be, that the publication is difficult to find. Therefore the whole text can be found on the Project homepage: www.muschelseide.ch/en/bibliographie/Monographien.xhtml .

7Maeder *et al.* 2004.

- 8 German: Muschelseide; Italian: bisso marino, French: soie marine.
- 9 Common names in English: noble pen shell, fan mussel; Italian: Pinna marina, nacchera; French: jambonneau, nacre; German: Edle Steckmuschel. For the biology of the *Pinna nobilis* see Poli 1795; Seydel 1909; Turner and Rosewater 1958; Czihak and Dierl 1961; Zavodnik *et al.* 1991; de Gaulejac 1993; Vicente 2000; Šiletić 2004.
- 10 European Council Habitats Directive 92/43/EEC, on conservation of natural habitats and the wild fauna and flora. Annex IV, Animal and Plant Species of Community Interest in Need of Strict Protection.
- 11 The byssus fibres may show different shades of brown to olive green till black, depending on the location of the fan shell. The cleaned fibres can be lightened with lemon juice before or after further processing.
- 12 On the Sardinian island of Sant'Antioco still live several weavers who have learned the craft of sea silk processing, but they exercise it only for demonstration purposes in a very small range. At the here presented workshop of 2013 in Lecce, the two weavers Assuntina and Giuseppina Pes demonstrated the whole process (see this volume).
- 13 A selection: Braun 1680; Chambers 1753; Rosa 1786; Mongez 1818; Scot 1827; Gardner Wilkinson 1842; Yates 1843; Gilroy 1845; Long 1846; Smith 1854; Bock 1866; 1895; Forbes 1956; Wipszycka 1965; Vial 1983; Sroka 1995; Kersken 2008.
- 14 For instance Barber 1991.
- 15 Quenouille 2005.
- 16 Blümner 1875, 179–180.
- 17 Beekes 2009, 249.
- 18 OED, www.oed.com (12.4.2014).
- 19 Laufer 1919, 574. Schott, Wilhelm (1849) Ueber das altaische oder finnisch-tatarische Sprachengeschlecht. See also Pelliot 1959.
- 20 Róna-Tas 1975, 155–163.
- 21 Ecsedy 1975, 145–153. She mentions another textile material that could be interpreted as sea silk: "... while the basic raw material of some other cloths had been an issue of a sea creature, and for the Chinese, acquainted with Inner-Asia, a 'thread-producing' animal living in the sea could mean but a 'sea-sheep'". But she doesn't connect it with böz.
- 22 Raschmann 1995, 64–95.
- 23 Dalley 1991, 121–123.
- 24 Beck 1883. Some of them are dissolved in the history chapter of the Project homepage: www.muschelseide.ch/en.
- 25 Dalley 1991, 121–122. The illustrations in the paper let me doubt if Dalley ever has seen or touched real sea silk.

26 Villard 2010, 394: “Byssus, a very fine fabric of great value, made from the filaments produced by mollusks, was reserved for some luxury clothes.” (translation by the author). See also: Burke 2012.

27 Smith *et al.* 1890. See also: German: *Paulys Real-Encyclopädie der classischen Altertumswissenschaft*, term Byssos (vol. III, 1, Olck 1897); Italian: *Treccani, Enciclopedia Italiana di scienze, lettere ed arti*, term BISSO (vol. 7, L. M. C., G. Cal., G. Mon. 1930); French: *L’Encyclopédie, Texte établi par D’Alembert – Diderot*, term BYSSE ou BYSSUS (Tome 2, de Jaucourt 1751, 471–472).

28 Yates 1843: Pinna fibres 152–159, Byssus 267–279; see also Gilroy 1845, who makes the same distinction between byssus as linen and the “Fibres or silken material of the Pinna”.

29 For the term byssus in antiquity and the connection to eventual sea silk in other cultures see Maeder 2008, 111–113.

30 Lombard 1978, 112: “Cette matière rare était employée dès l’Antiquité. C’était le butz des Hébreux, le byssos des Grecs, le byssus des Latins.”

31 Chambers 1753.

32 Quenouille 2005, 242.

33 Wild 2007, 5.

34 For the term byssus in the Bible see also in French: Rondet 1776, 850, in German: Schrader 1886, 195.

35 Douay-Rheims, 1582, a Roman-Catholic Bible; King James, 1611, a translation of the Church of England; Darby Version, 1890, a translation of the Bible based on the Hebrew and Greek texts; New Revised Standard Version, 1989, an updated revision of the Revised Standard Version, which was itself an update of the Authorised King James Version.

36 La Sacra Bibbia tradotta in lingua italiana e commentata da Giovanni Diodati, Genève 1641/1649; Bibbia sacra secondo la volgata tradotto in lingua italiana da Monsignor Antonio Martini, Londra 1821; La Sacra Bibbia ossia l’Antico e il Nuovo Testamento, versione riveduta in testo originale 1927; Conferenza Episcopale Italiana, Bibbia rivista in base ai testi originali (ebraici, aramaici e greci), secondo le migliori edizioni oggi disponibili, C.E.I. 2008.

37 La Bible, qui est toute la sainte Escriture du Vieil et du Nouveau Testament: Autrement, l’Ancienne et la Nouvelle Alliance. Le tout reveu et conferé sur les textes hebrieux et grecs par les Pasteurs et professeurs de l’Eglise de Geneve, Genf 1588 (with a preface from Jean Calvin); La Sainte Bible des Eglises réformées de David Martin 1744; Bible de John Nelson Darby, traduite en Français, 1859; La Bible en français, version Louis Segond 1910, protestante.

38 For the German translations see Maeder 2015.

39 Parts of the books of Daniel and Ezra were written in Aramaic.

40 In the newest online available version of the King James Bible it is silk

again: www.biblegateway.com .

41 Two other discussed terms which may indicate linen in the Hebrew Bible – Eṭūn and Kūtoneth – are not translated as *byssus* in the Vulgate and so not included in this study (Nahum Ben-Yehuda, pers. comm. 2013).

42 One exception in my choice of verses is Ex. 28:6, where Bād is translated *bysso* .

43 One exception is Esther 8:15, which I did not include in my study: here Būṣ is translated with silk – *serico* in Latin. In French Bibles it is not translated with silk, but with linen or byssus.

44 In German translations, the idea of cotton is first seen in a German Bible of 1871, where the term *byssus* for Šeš is explained – in brackets – as *feinste weisse Baumwolle* , finest white cotton. In 1951 also Būṣ – in Latin *byssus* – is translated cotton.

45 This table includes terms of other Bible editions than the ones mentioned in the text.

46 See Maeder 2015; 2016.

47 In the Bible of Luther we find the term *gele Seide* .

48 White silk is also found in a translation of Josephus' Jewish War: "... Greek serikos ('made of the precious white silk, byssus') ..." (Meščerskij 2003, 680). Also Braun 1680, 914, in his book about the Hebrew priestly clothing, mentions *vestes ex bysso alba* , of white *byssus* , without specification of the fibre material.

49 "Stoffa di tela finissima a tessuto uniforme, per ricami, tovagliato e sim." www.treccani.it/vocabolario/bisso/ (30.4.2014).

50 Here I am in disagreement with Campi 2005, 201–201: "L'uso millenario della parola bisso per indicare la seta marina ricavata dal mollusco bivalve denominato pinna nobilis, ha lasciato esili tracce anche in alcuni testi della Bibbia. ...non è da escludere che le istruzioni riguardanti le vesti per i sacerdoti si riferiscano al prodotto ricavato dalla pinna nobilis."; Kersken 2008, 20–30, who takes Byssus as a textile of sea silk mixed with another fibre; and Müller, Babin and Riecke 2013, 320, who take Byssus not as a specific material, but as a term of quality, possibly hiding linen, cotton and sea silk: "Byssum ist kein bestimmtes Material, sondern ein Qualitätsbegriff, hinter dem sich die Rohstoffe Leinen, Baumwolle und Muschelseide verbergen können".

51 Nahum Ben-Yehuda, pers. comm. 2013.

52 Vol. 2, 264. He mentions here shortly the antique byssus from Elide or Judea, which is treated extensively under the term Bysse.

53 Fabbroni 1782, 25.

54 Bezon 1857, vol. 1, xlix. In vol. 8 of 1863, 401 he mentions Aristotle a second time: "La pinne-marine est nommée coquille porte-soie par Aristote, qui signalait dans le byssus de ce mollusque une fibre textile." In the same volume,

Bezon brings a new term for sea silk: “On appelle ablaque dans le langage commercial, le byssus de la pinne-marine”, referring probably to the erroneous entry in the *Dictionnaire pittoresque d’histoire naturelle et des phénomènes de la nature* of 1834. Diderot’s entry was probably correct: “ABLAQUE, s. nom que les François ont donné à la soie de perle, ou ardassine. Cette soie vient par la voie de Smyrne; elle est fort belle: mais comme elle ne souffre pas l’eau chaude, il y a peu d’ouvrages dans lesquels elle puisse entrer.”

55 Pliny mentions byssus as flax, not as sea silk, and neither of the two mention a fabric.

56 Mongez 1818, 228–229; Laufer 1915, 106; Zanetti 1964, 246; Carta Mantiglia 1997, 90.

57 Müller 1837, 1–3, especially footnote 2.

58 Beullens and Gotthelf 2007, 471, 503.

59 van der Feen 1949, 66–71; he mentions an additional spelling problem.

60 Beullens and Gotthelf 2007, 469–470; Moerbeke’s version was printed – partly – only in 1908.

61 Beullens and Gotthelf 2007, 470.

62 Beullens and Gotthelf 2007, 503.

63 van der Feen 1949, 69. Unfortunately, with the English translation from D’Arcy Wentworth Thompson in 1910, the incorrect text persisted till the beginning of the 20th century: “The pinna grows straight up from its tuft of anchoring fibres in sandy and slimy places”. It is still online http://classics.mit.edu/Aristotle/history_anim.5.v.xhtml (30.4.2014).

64 van der Feen 1949, 70.

65 Beullens and Gotthelf 2007, 503.

66 A French version followed in 1558.

67 Rondelet 1558, 38–39: “... qui servira à mieux entendre aucuns lieux du vieil Testament é plusieurs des autheurs prophanes.”

68 This is probably the reason why the idea, that byssus – in the meaning of sea silk – doesn’t take fire, persists till today.

69 “... le plus exquis de tout le monde”

70 “... pour les delices des femmes” meaning linen.

71 “... qui reluisoient comme” or the golden colour may be the reason, why it has been taken as sea silk.

72 “... c’est vne espece de lin en Indie ... lequel croist en vn arbre” – cotton is meant. Also these four “byssus of the land” have somewhere, sometimes, in different languages been explained as being sea silk.

73 “L’autre Bysse est celui de mer, qui sort de la pinne comme soie tres molle é delicate, de couleur brune ainsi nommé, pour la similitude qu’il ha avec celui de terre qui croist en Grece é en Iudée.”

74 Rosa 1786, 75–76: “... il risplendente e preziosissimo Bisso di varie specie e bellezze e terrestre e marino ...”. Rosa uses the term bisso marino for sea silk: “... qualche altro pelo che pochi animali ci somministrano, come quel del Castoro e dell’ Astura [*Pinna nobilis*], che è appunto il bisso marino dell’ Aldrovandi, materie tutte o di poco uso o di carissimo prezzo.”

75 The entry profile of OED says that byssus is one of the earliest 10% entries recorded; quotation evidence from 1398 (first cited in John Trevisa): J. Trevisa tr. Bartholomew de Glanville *De Proprietatibus Rerum* (1495) xvii. xcvi. 664: “Therbe many manere flexe, but the fayrest of al growyth in Egypte: for therof is Bissus made ryght fayre and whyte as snowe.”

76 Pelliot 1959, 530; see also Sroka 1995; Makbili 2013.

77 Giovanni da Uzzano: La pratica della mercatura nel 1442 (Pagnini della Ventura and Balducci Pegolotti 1766); see also Pignotti 1843, 155; Licatese 1989, 119.

78 The first time mentioned in Rudolph 1766.

79 van der Feen 1949, 66.

80 “Nor was it enough to comb and sow the materials for a tunic. It was necessary also to fish for one’s dress. For fleeces are obtained from the sea, where shells of extraordinary size are furnished with tufts of mossy hair.” Source: <http://www.tertullian.org/>

81 Homiliae in Hexaemeron, 7,6. For the Greek texts of this and the following statement see Yates 1843, 155–156.

82 An extensive study of the probable material of the Golden Fleece has been written by Cole 2005.

83 De Aedificiis, III, I, 17–20; see also Gilroy 1845, 174–184; Gibbon [1879], 173.

84 Marzano 2013, 171–172. To produce 1 kg of sea silk, the byssus beard of up to 4000 fan shells were necessary.

85 Makbili 2013; thanks to Nahum Ben-Yehuda for telling me about this study and for the translation in English.

86 Hollendonner 1917, 35–37; Nagy 1935, 35–39; Wild 1970, 20; Maeder 2008.

Morphology, Properties and Microscopical Identification of Sea Silk

Anne Sicken

Introduction

Even though sea silk, one of the rarest and most precious textile fibres, has been well known since ancient times, it had been little investigated up to the end of the 20th century. That changed in 1998 when Daniel McKinley published the first monograph about this subject.¹ In the same year Felicitas Maeder independently started the project “Sea-silk” at the Natural History Museum Basel.²

Since that time interest in the subject of sea silk has increased. Again and again “new” objects assumed to consist of sea silk have been found. A well-known example is the veil of Manoppello.³

A clear identification of sea silk, which is often referred to as byssus, using historical sources is difficult because of the double meaning of the term.⁴ It is not always possible to make a definite statement about the nature of the material by relying solely on a contextual assessment of the collection or on archival research. As a consequence, the option of undertaking microscopical identification of sea silk for conservation-based studies, that means non-destructive or minor-destructive, is growing in importance. Therefore this paper demonstrates the possibilities for the identification of sea silk using microscopical methods on the example of a currently discovered sea silk object: A small sample of cloth of merino wool with golden wefts of sea silk which was found in the German cloth-making town Monschau.

This paper gives a brief overview of the morphology and properties of sea silk and a detailed description of the potential of microscopical identification on the basis of incident/transmitted light microscopy and scanning electron microscopy using the afore mentioned sample of cloth.

Morphology and properties of sea silk – a brief overview

- Sea silk is a product of the *Pinna nobilis* L., the largest shellfish of the Mediterranean Sea. It fastens itself in the sand along the coast with the byssus, a bundle of very fine strong filaments. These filaments have a length of up to 20 cm.

- *Pinna* and other marine mussels are capable of producing the long anchoring

fibres by secretion from the byssus gland which is located at the base of the foot of the shell.

- The first liquid protein secretion hardens only in contact with water to fine, highly durable and extremely tear-resistant threads. These threads constitute the raw material for producing sea silk.

- The byssus of an adult mussel weighs approximately 2–3 g. After washing, drying and combing significantly less material, about 20 per cent, remains.

- Sea silk is similar to the byssus of other mussel species and in many respects it is similar to the mulberry silk as well as to the silk of spiders.

- Like mulberry silk, which consists of fibroin fibres in a sticky resin, called sericin, byssus threads also have a sheath-core structure and are natural bi-component fibres.

- The byssal threads secreted by other marine mussels have been intensively investigated in recent years, in view of possible applications in biomimetic materials for engineering and also for medical purposes.⁵



Fig. 3.1. Natural colour of the cleaned and combed fibre beard of Pinna nobilis (© A. Sicken).

As a result of these investigations byssal threads were found to consist of a water-insoluble fibrillar collagen-like component, but also contain elastin-like areas.⁶ These elastin-like areas are held responsible for the exceptional ductility of the byssus. The fibrillar component is coated with a thin, hard and protective cuticle. This cuticle consists of a polyphenolic protein containing DOPA (3, 4-dihydroxy-l-phenylalanine) and catechol oxidase.⁷ This is similar to the

silkworm's sericin protein coating. The polyphenolic resin plays a particular role for the adhesion and abrasion resistance, since the hydroxyl groups of DOPA are mainly used as an irreversible attachment to solid surfaces through the formation of hydrogen bonds.⁸

The natural colour of the cleaned and combed fibre beard of *Pinna* (Fig. 3.1) varies, depending on the location, and possibly on the age of the shell. We find bronze or copper colour, golden yellow to brown, and olive green to black. Pheomelanin was found to be the main pigment of byssal threads.⁹ Melanins are the most popular pigments in the animal world. They are responsible for the colour of skin, hair, eyes and feathers.

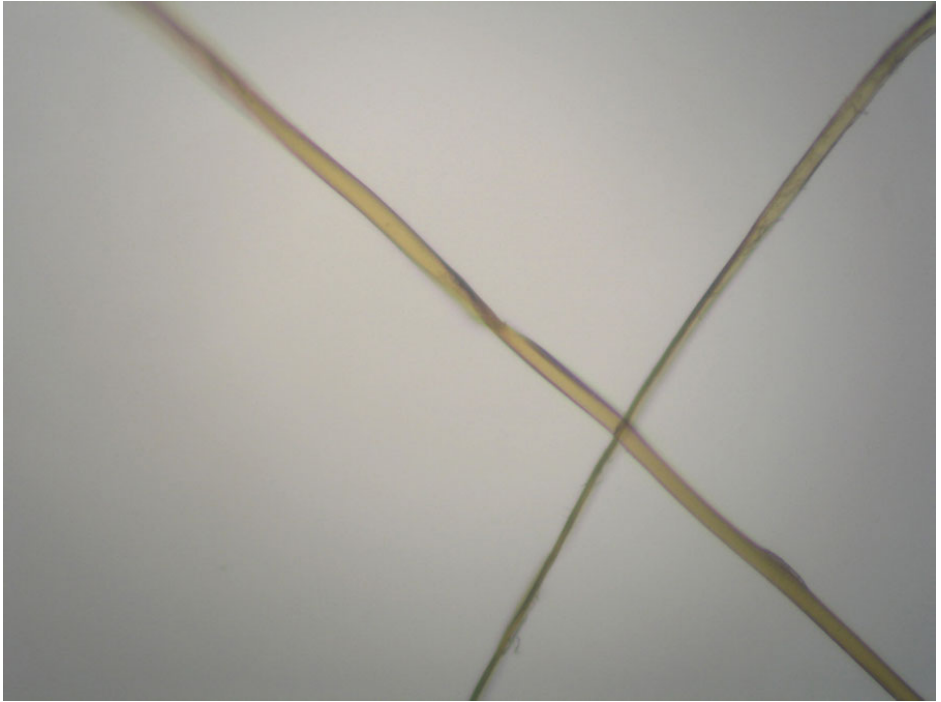


Fig. 3.2. Transmitted light micrograph of a *Pinna nobilis* byssal thread $200\times$ (© A. Sicken).

Whether sea silk was ever dyed has been discussed controversially in the literature to date. First colouring experiments with purple by Inge Boesken-Kanold¹⁰ as well as with synthetic dyes by the EMPA¹¹ have been carried out with unconvincing results. This is not surprising, because the thread surface of sea silk is hydrophobic. This hydrophobic character corresponds to the protective role of the cuticle in natural aqueous environment of mussels. On the other hand, to achieve an effective dyeing result the water-soluble dyes have to be absorbed and homogeneously dispersed in the fibres. Because of the hydrophobic cuticle of sea silk no uniform absorption and no uniform surface coverage can be obtained, as in the case of other natural fibres.

However, it is likely that sea silk was valued because of its natural hue,

which allows the implication that usually no staining was carried out. This is evidenced by the fact that no dyed objects have been found to date.

It is important to distinguish between dyeing and brightening of the fibres. It is undisputed that the treatment of sea silk with lemon juice as well as the application of lemon juice on the threads or the finished objects causes a brightening of the natural hue. Under the transmitted light microscope sea silk appears as flat, twisted, very finely friated fibres (Fig. 3.2). The surface is smooth; the diameter of sea silk fibres is comparable to other animal and vegetable fibres.

Investigations by scanning electron micrograph clearly show the almost smooth, featureless surface with fine longitudinal lines (Fig. 3.3). Sometimes rough separated particles on the surface can be found. Characteristic is the significantly elliptical or almond-shaped cross section (Fig. 3.4) which is not found in any other natural fibre. Thereby sea silk can easily be proved by light microscopy und well distinguished from the very similar mulberry silk, which shows a rounded triangular cross-section.

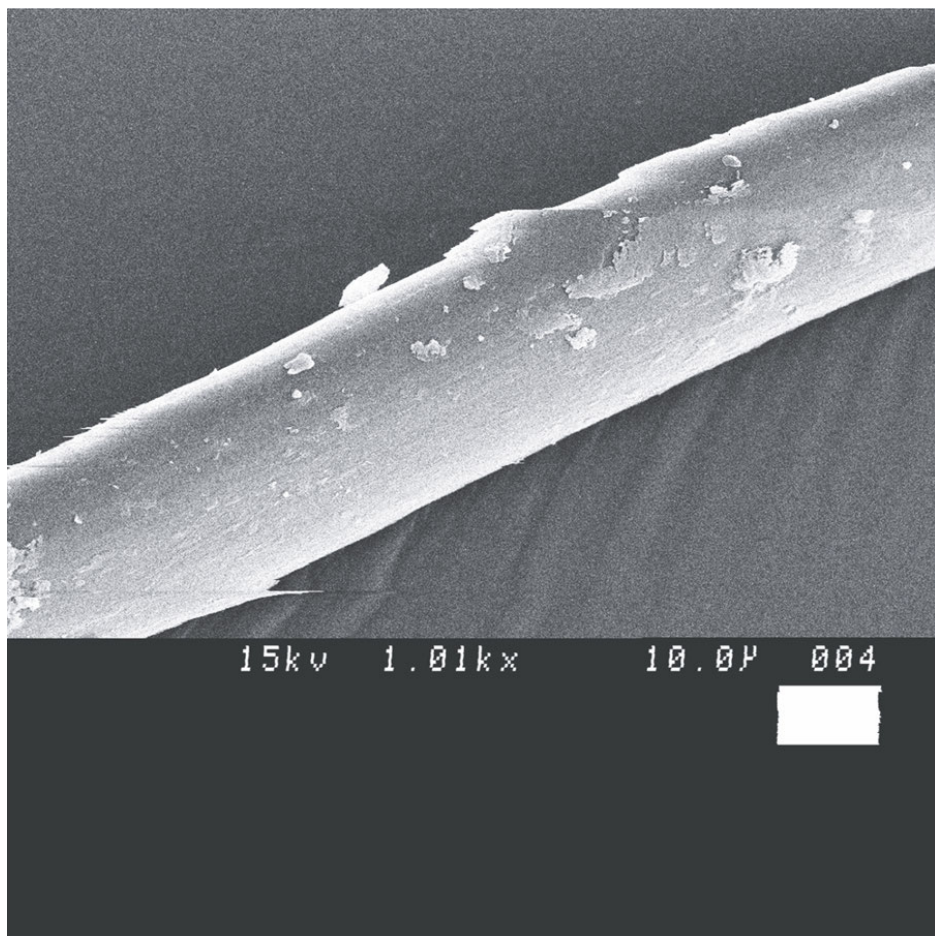


Fig. 3.3. Scanning electron micrograph of a *Pinna nobilis* byssal thread 1,000 $\times$ (©

A. Sicken).

Another way of distinguishing between the similar fibres is the reaction with the specific chemical reagent Kuoxam (cuprammonium hydroxide). Whereas degummed mulberry silk rapidly disintegrates into smaller pieces and then dissolves completely, byssus only undergoes a significant, swelling of the fibre increasing with time.

The fibre diameter varies – even along single fibres – between 10 and 60 μm . Sea silk, particularly wet sea silk, is extremely stretchable. The tensile strength is low compared with other protein fibres, even weaker than wool. In wet state the tensile strength decreases by about 47%.¹²

Sea silk is translucent in strong light (Fig. 3.5). Especially in incident light from the side it shows its typical golden yellow metallic brightness.

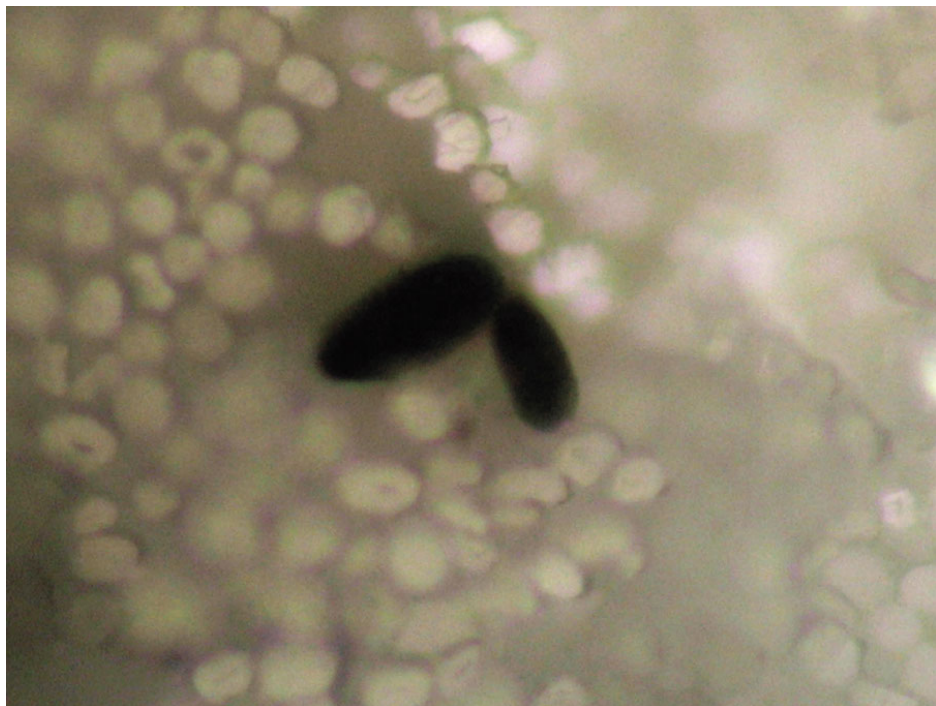


Fig. 3.4. Elliptical fibre cross-section of a *Pinna nobilis* byssal thread (© J. Hiske).

Microscopical identification of sea silk using the example of the sample of cloth No. 2384 from a pattern book in the “Roten Haus” in Monschau

Today more than 60 objects made by sea silk have been documented.¹³ Almost half thereof are knitted gloves. The most known objects from sea silk date from the 18th and 19th centuries, especially from Sardinia or Taranto. Purchasers or recipients of these textiles were oftentimes those numerous travelers to Italy who were interested in natural history. Sea silk textiles have also been used as gifts in aristocratic circles of church and state.

There are strong indications that the manufacturing of sea silk quantitatively has been only a niche product. Because of the complex production and processing of the raw material and the low yield it was highly appreciated as a luxury good. Precious textiles were traded at all times and used as gifts. In spite of the small quantity of sea silk goods a trade across the borders of Italy has taken place. This can be confirmed by commercial documents, where sea silk is mentioned¹⁴.

The export of sea silk goods has also been confirmed by the latest trove: A small sample of cloth in the pattern book of the *Feine Gewandtschaft* which is shown in the *Roten Haus* in the German cloth-making town Monschau, south of Aachen. The leather-bound pattern book was created in Napoleonic times for an industrial exhibition which took place in Aachen 1813.

It contains samples of cloth of all fine fabrics made between 1760 and 1810 in Monschau. The patterns have been extremely well preserved regarding their quality and colour. The book consists of 40 sheets, whereof 30 contain patterns. Every sheet is related to a page of text with information on raw materials, colour, year of manufacture and exporting countries.

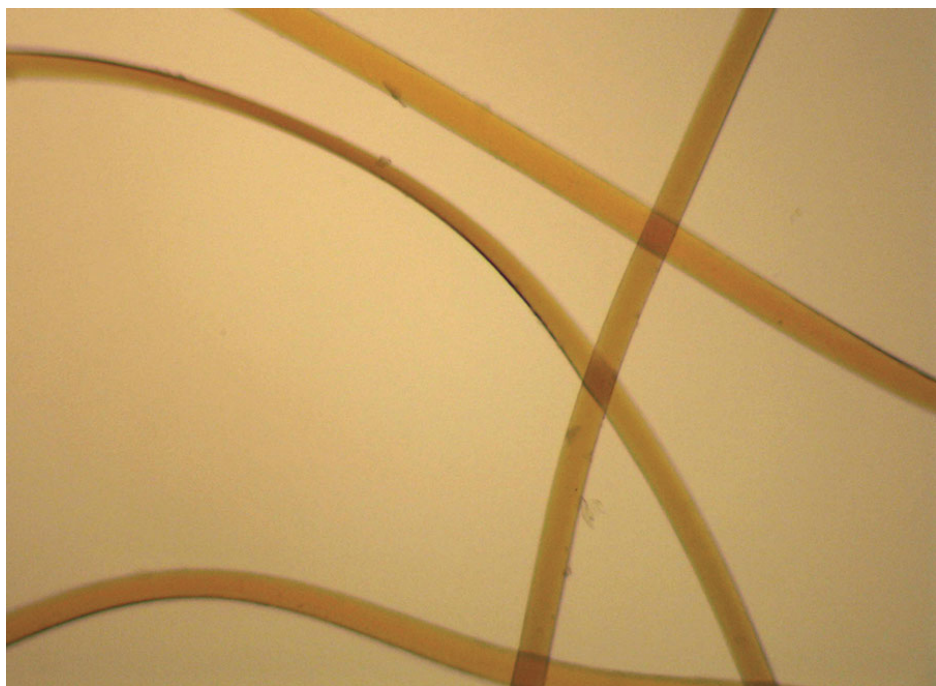


Fig. 3.5. Sea silk is translucent in strong light (© J. Hiske).

Felicitas Maeder, who had found written evidence for the processing of sea silk in Monschau¹⁵, travelled to Monschau in May 2011 to look at the pattern books in the *Roten Haus*. On page 20 of the pattern book of the *Feine Gewandtschaft* she found a reference to a sample of cloth No. 905 from “Pine marine”. At the expected position the sample of cloth should be she only found a hint that the pattern had been taken out of the book in 1851. When further

inspecting the book Felicitas Maeder discovered on page 33 (Fig. 3.6) another sample of cloth, showing the characteristics of sea silk, but no reference in the corresponding text could be found.

For this reason, in the fall of 2011 a very small sample of the golden wefts and the brown ground fabric from this pattern marked with the number 2384 (Fig. 3.7) was taken.

The scientific fibre analyses were performed with a transmitted light microscope BH-2 Olympus and a digital light microscope VHX-500 FD Keyence at the Cologne Institute for Conservation Science. In addition an investigation with a scanning electron microscope ISI SX 30 E was done at the company Clariant.

Using the digital light microscope the longitudinal view of the sample of the golden wefts shows fine, ribbon-like shiny gold fibres (Fig. 3.8). Using the microscope with transmitted light the fine streakiness of the fibers appears. The fibre diameter ranges from 9–18 μm and thus shows a characteristic value of sea silk.

Processed sea silk can hardly be distinguished from mulberry silk with the naked eye. However with its elliptical cross-section it can easily be detected by using an optical light microscope. The cross section of the fibres of the golden wefts has an elliptical shape, which is specific for sea silk fibres.¹⁶



Fig. 3.6. Page 33 of the pattern book “Feine Gewandschaft” (© A. Sicken).

Images of these fibres made by the scanning electron microscope show a smooth surface, with fine longitudinal grooves and sometimes crumbly covering.¹⁷

To sum up: The results of the fibre analysis certainly confirm the identity of sea silk in the sample of cloth No 2384.¹⁸

The fibre sample of the brown ground fabric shows the characteristic scaly structure of wool fibres and a strong crimp. The average fibre diameter is below 25 μm . These features are important characteristics for fine merino wool. Thus the ground fabric consists of brown coloured merino wool.



Fig. 3.7. Sample of cloth No. 2384 on page 33 (© A. Sicken).



Fig. 3.8. Incident light micrograph of the sample of the golden wefts (© A. Sicken).

Summary and outlook

After it had been clearly confirmed by the fibre analysis that the sample of cloth No 2384 consists of merino wool with golden wefts of sea silk, new fields

of research have now been opened up. At first the question arises to what extent sea silk was used in other places outside of Italy for the manufacturing of precious cloth. Therefore a further examination of the pattern books at the *Roten Haus* in Monschau is planned but also the visual inspection of pattern books in other important places connected to the cloth industry of the 18th century. To obtain further information about the structure, material properties and ageing behaviour of sea silk, comprehensive scientific studies shall be carried out. In addition, the development of non-destructive or minor-destructive testing methods for the quick identification of sea silk directly on site is planned. Such a method could be used when archaeological textiles are found or when textile collections are investigated. It is expected that additional to date undetected sea silk objects can be found not only in natural history collections, but also in various cultural historical collections.

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1McKinley 1998.

2Maeder *et al* . 2004.

3Jaworski 2010.

4In biology the beard of various mussels is called byssus. Since ancient times the term byssus has also been used for precious fine ancient textiles of linen, cotton or silk: Sroka 1995.

5E.g. Harrington *et al* . 2010.

6Coyne *et al* . 1997.

7Waite 1990.

8Ebert 1993.

9Jaworski 2010.

10 Inge Boesken Kanold experimented with dyeing sea silk fibres with purple during the workshop “Treasures of the sea”. Only a slight darkening of the fibres could be achieved.

11 <http://www.muschelseide.ch/de/biologie/byssus/faerben.xhtml>
(18.3.2014).

12 <http://www.muschelseide.ch/de/biologie/byssus/faseranalyse.xhtml>
(18.3.2014).

13 <http://www.muschelseide.ch/de/inventar.xhtml> (18.3.2014).

14 <http://www.muschelseide.ch/de/geschichte/neuzeit/Handel.xhtml>
(18.03.2014).

15 Maeder 2012.

16 Because of the very limited sample availability, the fibres were embedded in viscose to produce the cross-section.

17 The fibre samples were sputtered with gold. When performing SEM investigation of sea silk a coating with gold is preferred, because of the higher yield of secondary electrons compared to a coating with carbon. So the smooth surface structure can be recognised better.

18 Sicken 2012.

Tangled threads. Byssus and sea silk in the Bronze Age: an interdisciplinary approach

Elena Soriga and Alfredo Carannante

Introduction

The term “byssus” indicates, at least from the 2nd century AD, sea silk, a precious golden fibre produced by the Mediterranean bivalve *Pinna nobilis*.

Since the 9th century BC, Syrian and Mesopotamian tablets mention textiles and fabrics in a precious fibre named byssus (Akk. *būšu*; Aram. *bš*). Some related terms (Heb. *bûš*; Gr. *byssos*; Lat. *byssus*) occur then for the remainder of the 1st millennium BC in the Classical and Biblical textual sources. The nature of this fibre is still controversial and the term is generally interpreted as the finest quality of linen rather than sea silk.

This paper analyses the historical, geographical, economic and ecological horizon in which the earliest occurrences of the Semitic terms for “byssus” appear in order to verify whether such terms may refer to sea silk also at the beginning of the 1st millennium BC.

Considering the Bronze Age record, a multidisciplinary approach allows for the correlation of bio-archaeological and iconographical data with epigraphical ones. Several Bronze Age cuneiform texts contain terms and paraphrases that refer to a precious marine fibre. The coeval archaeomalacological data at Mediterranean sites evidencing a net increase of pen-shell exploitation in Late Bronze Aegean, and a possible iconographical attestation of the role of the pen-shell in Mycenaean rituals, suggest that sea silk exploitation had already started in the second half of the 2nd millennium BC.

Byssus and sea silk: an ancient linguistic tangle (E.S.)

Sea silk is a golden-coloured fibre produced by the *Pinna nobilis* and *Pinna rudis* mussels to anchor themselves to underwater surfaces, on rocky outcrops and sandy ledges. These saltwater molluscs, commonly known as “pen-shells” or “fan-mussels”, are the largest endemic bivalve species of the Mediterranean Sea, along the coast of which the manufacture of sea silk developed until modern times (Fig. 4.1).¹ Sea silk is also named byssus, a specific term indicating the strong filaments that allow several mollusc species to keep themselves attached to the rocks.

At Sant’Antioco and Calasetta, two small towns on the Sant’Antioco Island,

off the southwestern coast of Sardinia, pen-shells were gathered from the sea until the end of the last century.² Yet there the diaphanous fibre is still combed, spun and woven into stunning fabrics (Fig. 4.2) in the last sea-silk workshops in the world.³



Fig. 4.1. *Pinna nobilis* specimens in their natural ecosystem. The biofouling covers and camouflages the pen-shells. Though they are bivalve molluscs, to the untrained eye they look like plants rooted in the seabed or even stones (graphic elaboration: E. Soriga).

Archaeological and textual sources testify that sea silk was known and used since Late Antiquity. The most ancient archaeological evidence for the use of sea silk is a scrap of textile from Aquincum, modern Budapest, dating back to the 4th Century AD.⁴ In the 2nd Century AD Tertullian (*De Pallio* III, 6) refers to some luxury garments, certainly made of sea silk.⁵ In the same period, Philostratus and Alciphron report about a kind of wool ἐκ τῆς θαλάττης “from the sea” used also to make gloves as was done in more recent times.⁶ Around the 3rd century AD Chinese chronicles record the import of hair of the *shui-yang* “water (or marine) sheep” among other marine matters typical of the Roman Empire (*Ta-Ts’in*) as coral.⁷ This animal fibre was woven for the manufacture of a fabric called *Hai-his-pu* “western cloth from the sea”.⁸

Sea silk/pen-shell byssus exploitation is surely attested in the first centuries AD but its use in the 2nd and 1st millennia BC is still controversial. Indeed the term “byssus” is quoted already in several languages in the texts of the 1st millennium BC but was such a term utilised to describe sea silk?⁹ Though byssus is described in these texts as a kind of very fine and light fibre as well as sea silk, it is never explicitly linked to marine resources.¹⁰ Furthermore, Lat. *byssus* and Gr. βύσσος do not have an Indo-European origin. They are indeed related with earlier Semitic terms (Heb. *bûš*; Ph. *bš*; Akk. *bûšu*). The few texts that quote these terms do not occur before the 1st millennium BC.

In accordance with Classical and Biblical sources, the greater part of philologists translated the words from which the English word “byssus” derives, as a vegetal fibre too. Indeed, many scholars deem it not appropriate to recognise the byssus quoted in 1st millennium BC texts as sea silk.¹¹ Such an assumption is strongly supported by the comparison of the three texts inscribed in the famous Rosetta Stone. Here the Greek adjective *byssinon* has been

translated in Egyptian as “king’s linen” (*ššn sw*).¹² Therefore, in past specialized literature ancient byssus has been almost always interpreted as a vegetal fibre.

In the Old Testament, Hebrew *bûš* “byssus” was interpreted, as well as the word *šēš*, as a first-rate quality linen. This superfine quality of linen was used to make ceremonial clothing such as the tunics used by the king and high priests.¹³ The Akkadian term *būšu* is commonly translated as “fine linen, byssus” too.¹⁴

Thus evidence from the Iron Age, both from the Mediterranean and the Near Eastern area, suggest that the fibre named byssus had nothing to do with sea silk and pen-shells. Nonetheless, an analysis of the economic and ecological context in which the 1st millennium BC byssus is quoted, could supply a new point of view of this tangled issue.

The main peculiarities that distinguish sea silk from the animal and vegetal fibres used in the ancient textile industry are:

- a high economic and symbolic value and the characteristic golden-brownish colour
- the marine origin and thus, consequently, a provenance from Mediterranean coastal regions.

The first step to verify if sea silk was exploited in the 1st and 2nd millennia BC textile industry is to examine the presence of its peculiarities in the coeval texts.

Golden textiles as robes of kings and gods

It is beyond doubt that the natural golden colour is the most fascinating feature of sea silk, the hues of which can turn from brown-reddish shades to golden and greenish ones (Fig. 4.2).¹⁵ Nevertheless, during the 1st millennium BC no text describes byssus or even less specifies whether it was coloured and if so, of what colour. Only a few passages in the Old Testament could provide indirect evidence that byssus had this striking characteristic since *bûš* was often mentioned together with coloured textiles such as crimson, red-purple or blue-purple wool.¹⁶ Its decorative use in weaving and especially in embroidery of sacred vestments and furnishings would suggest that in itself it was perhaps a fibre with a particular colour.¹⁷

From the cuneiform tablets, it is known that in Mesopotamia *būšu* was manufactured in headgears reserved for the members of the royal family and the king: a Neo-Assyrian text records a turban of byssus (Akk. *bu-u-zu TÚG SAG*) whilst a coeval text from Babylon counted a headband (Akk. *muttatu*) woven in a sophisticated quality of red-purple wool and embroidered with byssus threads or *viceversa* (*tabarri KÙ būšu ṭimītu*).¹⁸ These headdresses fit suggestively with the turban and the headbands of byssus mentioned in Exodus XXXIX, 28 and with the sea silk hat, that archaeologists have found in St Denis near Paris and dated to the 14th century AD.¹⁹

During the Bronze Age similar headgears were already paraded by the sovereigns in civil and cult ceremonies as status symbols and attributes of their power ideology.²⁰ Some texts from the Syrian city of Ebla (24th century BC) refer to a kind of golden turban named *tiparānum*, made in linen and precious metals.²¹ It was assigned exclusively to the king and to the god dKU-ra, the one who protects the throne, the king and the institution of kingship itself through the cult of the dead kings.²² A text from the archives of the Syrian city of Mari (18th century BC) lists “linen threads for a turban of golden brown (Sum. *ḫuš-a*) wool”.²³

Therefore, in Early and Old Syrian culture, linen embedded with golden elements – or directly wool dyed in this colour – was used to make headgears, a symbol of royalty, in place of the *būšu*.²⁴

Considering Mesopotamia, during the III Dynasty of Ur (21st century BC) the Neo-Sumerian texts attest that the *síg-ḫuš-a* “reddish golden wool” was a minor part of the textile production: only the fibres of superfine (*šār/lugal*) quality have this colour and were intended for the manufacture of the *túg-ḫuš-a* and *tug-nì-lám* (Akk. *lamaḫuššû*), textiles and garments reserved for the king and for the members of the royal family.²⁵ The Sumerian *ḫuš-a* and its Akkadian calque *ḫuššû* (*m*) indicate an amber colour the reddish tinges of which are characteristic of gold, honey or date syrup, copper and hair of some swine.²⁶



Fig. 4.2. Natural hues of sea silk tufts and threads from the Ethnographic Museum of Sant'Antioco, Sardinia. Top: fibres of a piece of a fabric woven in sea silk. Below: pearls of *Pinna nobilis* (photos: E. Soriga).

Though sea silk is still qualified as “wool” in several languages (It. *lana penna*, Fr. *laine de poisson*; Ar. *şūf al-baḥr*), its identification with the ḥuṣ-a wool is far from certain. Nonetheless the comparison between the headgears of byssus quoted in the 1st millennium BC textual documentation and the golden headgears listed in Bronze Age tablets among the royal status symbols, offer an interesting point of consideration as regards the possible colour of the precious fibre *būṣu/būṣ*.²⁷

Western provenance and marine origin

Most ancient epigraphic quotes of byssus date back to the 9th century BC.²⁸ One mention is a celebratory stele from the Aramean Sam'al, modern Zincirli

Höyük, in the Turkish Gaziantep Province; the other comes from the land of Suḥi, in the middle Euphrates valley between Balikh and Khabur rivers, in Syria.

The former text is a Phoenician inscription (KAI 24.12–13) that confirms the afore-said central role of byssus (Ph. *bš*) in the 1st millennium BC machinery of Near Eastern royal ideology. Indeed, Kilamuwa, king of Y'DY (Sam'al), boasted of his reign as a period of prosperity: “And he who from his youth had not seen linen, in my days was clad in byssus-cloth from head to foot”.²⁹ Sam'al, capital of the homonymous kingdom, was an important corridor in the trade between the Mediterranean coast and North-Mesopotamia. It is no accident that in the famous “lamentation for Tyre”, Ezekiel lists many marine products among the luxury goods traded by Arameans in Phoenicia: the fine fibre (Heb. *bûš*) is recorded besides red purple dye (Heb. *'argaman*) and red corals (Heb. *rā'mâ*).³⁰

On the other hand, the second text is a Cuneiform tablet in which Marduk-apla-ušur of Suḥi delivered a tribute to the Neo-Assyrian king Shalmanassar III (858–824 BC) that included textiles in byssus (*bu-û-ši*) and *lubulti birme u kite* “multicoloured clothing and linen”. According to L. Oppenheim these polychrome robes were typical “Western fashion” ites.³¹

Furthermore, a Neo-Assyrian letter sent to the king Sennacherib (about 705 BC) lists byssus among the typical goods of western origin. In the letter, Azuri, king of the Philistean city of Ashdod on the Mediterranean coast,³² sends luxurious textiles, a considerable amount of silver and a great quantity of salted Mediterranean fish, to the queen and other officials of the Assyrian court.³³ Overall, these data suggest that during the 1st millennium BC in many cases byssus arrived in Mesopotamia from the Mediterranean coast.

Sea silk in the Bronze Age Mediterranean? (E.S.)

The above-mentioned Rosetta Stone translates the Greek adjective βύσσινος as the Egyptian “linen of the king”.³⁴ In Early Dynastic times this kind of linen (e.g. *iti.wy*) is already attested in the “linen lists”. Later in the texts of the Old Kingdom (3rd millennium BC) royal linen was connoted as *idmy*.³⁵ In Cuneiform texts of the 3rd and 2nd millennia BC, some fibres, generally wool, are qualified as “of royal quality” too. The cuneiform texts from Old-Assyrian Kanesh (19th century BC), in Anatolia, record some robes designated as *ša (lubuš) šarruttim* “garments of the king”. Sometimes a variant of this denomination is *ekallium* “of the Palace”.³⁶ In the second half of the 2nd millennium BC the texts of the international correspondence between Egyptian and Hittite courts quote the Akkadian *kitū šarri* (GADA.LUGAL) “linen of the king”.³⁷

May all these paraphrases indicate the same fibre translated in the Rosetta Stone as *byssos*? Amarna and Bogazköy cuneiform tablets quote *lubulti šarri*, literally “royal fabric, dressing of the king”; E. Edel has interpreted them as

garments of byssus.³⁸ Yet, as already argued by C. Zaccagnini, it is more probable that *lubulti šarri* was the indication of the first rate quality of textiles as in Neo-Sumerian and Old-Assyrian classification.³⁹ However, even if *lubulti šarri* were made in byssus, as Edel states, no text is able to supply circumstantial evidence for the identification of this fibre with the sea silk.

Recently, S. Heinhold-Krahmer proposed an identification of the marine fibre in the Late Bronze Age cuneiform documentation.⁴⁰ By analysing the diplomatic exchange of gifts and prestige goods between Hittite and Aegean communities during the second half of the 2nd millennium BC, the scholar found in a text from Boğazköy the mention of SÍG ȚA-ZAR-TUM A.AB.BA “Wolle aus dem Meer”, namely “sea wool”.⁴¹ The above-mentioned modern denominations of sea silk as a kind of wool with marine features prove that the figure of speech named *catachresis* is a linguistic custom kept until contemporary times.⁴² The occurrence of this sequence of signs in the Hittite inventory list IBoT 1.31, 17 was already noticed by A. Goetze.⁴³ He considered the Akkadogram ȚAZARTUM as the yellowish-green colour of a wool “brought from the sea”.⁴⁴ Such interpretation was approved by Heinhold-Krahmer, who discussed the possibility that “gelb/grün Wolle vom Meer/aus dem Meer” was a fibre dyed with a particular kind of marine purple or dyed in a colour imitating the water-sea hues.⁴⁵ The Akk. *Țašartu* (*Țašertu/Țašaštu/Țatartu*) actually means “green” (Arab. *aḥḍar*).⁴⁶ Wool of *Țašartu* colour is recorded among the textiles in the cuneiform tablets of Nuzi and Ugarit to the Late Bronze Age.⁴⁷ Nonetheless, the term *Țašartu* has also a secondary meaning that can provide greater information about the exact chromatic hue of this colour. Also written with the Sumerogram SÍG.KA with the literal meaning “wool, hair of nose”, the word occurs in Old Babylonian texts with the meaning “dry (green) mucus”.⁴⁸ This colour looks very different from the green-bluish tints of the sea water whilst it has more affinity with the amber-coloured fibre of the fan mussels. As a matter of fact, in a recent translation of the afore-mentioned text from Hattuša, the periphrasis SÍG ȚA-ZAR-TUM A.AB.BA was interpreted as an early mention of sea silk, a brown-greenish marine “wool” that could have been exported by Aegean people as a prestige good.⁴⁹

The Sumerogram A.AB.BA (Akk. *ajabba*), meaning literally the “water of the sea” in the texts of el-Amarna, roughly coeval with the Hittite documentation, was the standard writing used to indicate the Mediterranean Sea.⁵⁰ Therefore, the wool ȚAZARTUM quoted in IBoT 1.31, 17 could simply mean a greenish fibre imported by Aegean peoples from the shores of the sea *par excellence*, the Mediterranean and not necessarily a marine fibre. Indeed, in the Mediterranean Bronze Age at least one other fibre shared chemical structure, fineness, shine and colour with modern sea silk, the wild silk from Mediterranean moths.⁵¹ Albeit it recalls an association of ideas that is as whimsical as grotty, the comparison between slime and wool is, nevertheless, able to suggest that a kind of green-yellowish fibre from the Mediterranean was known in textile

manufacture since the early 2nd millennium BC. In this period, the cultural and economic exchanges which blossomed between the Near Eastern and Mediterranean communities may have favoured the diffusion of new textile technology and raw materials.⁵²



Fig. 4.3. Map of the Central and Eastern Mediterranean with the sites where *Pinna* remains have been brought to light. Neolithic sites: 1 Dikili Tash; 2 Stavroupolis; 3 Lafrouda; 4 Tharrounia; 5 Kitsos; 6 Lerna; 7 Kephala; 8 Malia; 9 Paralimni-Nessia. Bronze Age sites: 10 Coppa Nevigata; 11 Monopoli; 12 Torre Santa Sabina; 13 Punta le Terrare; 14 Kastanas; 15 Mesimeriani; 16 Ayios Mamas; 17 Kastri and Skala Sotiros; 18 Glas; 19 Eleusis; 20 Kolonna; 21 Lefkandi; 22 Perachora; 23 Asine, Midea and Mycenae; 24 Lerna; 25 Helike; 26 Nichoria; 27 Pylos; 28 Ayios Stephanos; 29 Ayia Irini; 30 Akrotiri; 31 Saliagos; 32 Thermi; 33 Poliochni; 34 Knossos; 35 Pseira and Mochlos; 36 Palaikastro; 37 Ayia Triada and Kommos; 38 Malia; 39 Petras; 40 Troy and Beşik-Yassitepe; 41 Bakla Tepe; 42 Liman Tepe; 43 Panaztepe; 44 Hala Sultan Tekke; 45 Marki-Alonia; 46 Pyrgos-Mavroraki; 47 Erimi-Pampoula (graphic elaboration: A. Carannante).

The archaeomalacological and iconographical data (A.C.)

Taking into account the possibility of a sea silk exploitation in the Bronze Age Mediterranean, we have to verify the actual attestation of *Pinna* spp. remains in the archaeological record. The presence of *Pinna* remains at archaeological sites is an ambiguous indicator of sea silk production.⁵³ *Pinna* molluscs are easily collectable in shallow waters of Mediterranean bays and lagoons and supplied much appreciated meat until a few decades ago. In addition, their shell supplies the thickest nacreous layer among Mediterranean species making it a valued raw material for ornamental objects and a source of mother-of-pearl. Therefore, it is not surprising to find *Pinna* remains attestations widely spread in Mediterranean archaeological sites dating back from the Neolithic (Fig. 4.3).

Referring to Neolithic/Chalcolithic contexts *Pinna* exploitation is attested to at several sites.⁵⁴ According to L. Karali⁵⁵: “among the species preferred in the

Neolithic Age, *Patella*, *Cardium*, *Murex*, *Pinna* come first, primarily in Macedonia”.

Pinna remains are relatively more frequent in Mediterranean Bronze Age contexts in Italy⁵⁶ as well as in the Aegean (Fig. 4.3).⁵⁷ The archaeomalacological record evidences a rising importance of such species in the Mycenaean contexts of the Late Bronze in the Peloponnese and Attica but also at Coppa Nevigata in Apulia, a site strongly influenced by contacts with the Aegean.

Many remains have been found also in Cypriot Bronze Age contexts.⁵⁸ Some *Pinna* remains have been found at the Early Cypriote Pyrgos-Mavroraki site. The excavations revealed a Bronze Age “industrial” complex where different rooms were used for distinct productive activities: oil production, oil storage, ores melting, metal working, dyeing and textile production.⁵⁹ Although many fibres used for weaving have been identified in earth samples taken inside loom weights and spindle whorls found *in situ*, no sea silk fibre was found. Sites where both shell and textile remains are considered in an ecological perspective are extremely rare. A close cooperation between archaeomalacologists, specialists in weaving tools and specialists in ancient textiles would be, nevertheless, worth wishing for the future at sites where *Pinna* remains are abundant.

Considering the available Bronze Age archaeomalacological data⁶⁰, we can affirm that:

- *Pinna* exploitation was common in the Mediterranean area, particularly in the Aegean.
- Only few sites ⁶¹ provided rare worked *Pinna* shell remains, attesting that shells were not commonly collected as nacreous raw material to produce earrings, inlays, plaques and spatulas.
- Several sites ⁶² where hundreds of *Pinna* remains have been found show instead a significant interest in this mollusc as a resource (food? sea silk?).
- In particular, several Peloponnesian sites ⁶³ and Eleusis in Attica show a remarkable concentration of *Pinna* remains in the Late Helladic phases, particularly in LH III. ⁶⁴ Moreover, N.J. Gejvall and D.S. Reese ⁶⁵ at Bronze Age Lerna report a general growing trend toward LH II.

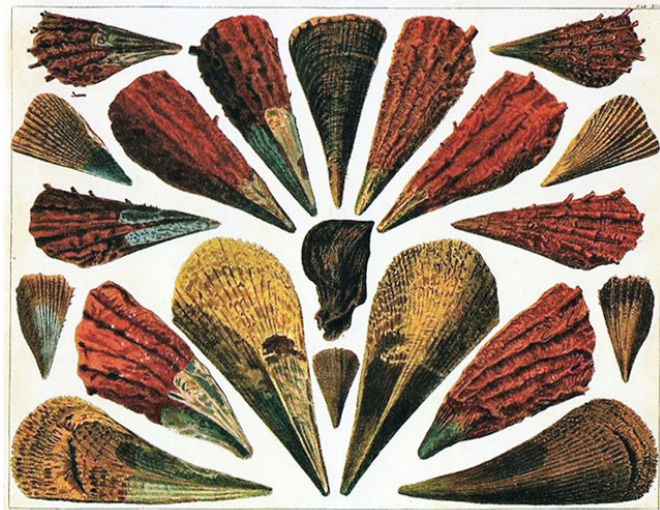


Fig. 4.4 Left: *Pinna nobilis*, *Pinna muricata* and *Pinna rudis* from the Indian Ocean, the Atlantic and the Mediterranean Sea. After Müsh et al. 2015, 439; right, top: goddess possibly holding two specimens of *Pinna rudis* from the lower panel of the Fresco from the Mycenae Cult Centre, Room 31 (drawing: E. Soriga); right, below: *Pinna rudis* (photo: A. Carannante).

How can we interpret such data?

We can infer that *Pinna* shell exploitation as a raw material was not the main purpose of its collection in the Bronze Age Mediterranean and that, instead, the living mollusc was the primary interest. We can hypothesise a change in food preferences during the Bronze Age with a growing appreciation in the Aegean for *Pinna* meat. This could correspond to a general trend of increasing interest in marine food resources.

Otherwise we can assume a coastal ecological change in the same period that favoured the increase of *Pinna* populations (e.g. expansion of Mediterranean lagoon areas or expansion of *Posidonia* meadows).

An additional hypothesis, however, is that the importance of the resource-*Pinna* in Peloponnesian society rose as a consequence of a new role for the mollusc in the LH economy. Such a conjecture suggests that the change in appreciation was due to the exploitation of the other resource offered by the living mollusc, the byssus to produce sea silk.

Iconographical data too suggest that in Late Helladic III Peloponnese *Pinna* spp. acquired economic and cultural importance. Some of the Mycenae pen-shell remains come from the rooms around the so-called Cult Centre, the walls of which were decorated with the famous fresco with three goddesses, each bearing its attribute: a sword, a sceptre and what has been described as “a flame-like object -the colour is brilliant red- but almost certainly the object represented is some kind of cereals” (Fig. 4.4).⁶⁶ As acutely suggested by B. Burke in a recent paper, this last object can be more correctly identified as an

accurate artistic representation of a *Pinna* shell.⁶⁷

The precision with which the ribbing and the colour are rendered by the artist, allow us an even more accurate identification as *Pinna rudis* (Linnaeus, 1758). This is a large bivalve easily distinguishable from *P. nobilis* by the 5–8 prominent radial ribs and reddish colour but which produces long byssus too. It is more abundant in the Southeast Mediterranean.⁶⁸

The presence of the female deity bearing in her hands two large *Pinna* shells strongly suggests that the ideological role of such a mollusc went far beyond its importance as a food resource in LH III Mycenaean culture. Moreover, the *Pinna* shell remains found in the same context confirm that this is not just an isolated hypothesis.

To write in riddles: the byssus terminology before the 1st millennium BC (E.S.)

Concerning the word from which “byssus” derives, the Akkadian term *būšu* occurs in Cuneiform texts with the meaning of fibre not earlier of the 9th century BC. At the beginning of the 2nd millennium BC, Old Assyrian texts quoted *būšu*, but in this period the word indicated an undetermined species of bird, maybe a kind of partridge.⁶⁹ Other two homonymous terms occurs since the Late Bronze Age, one that indicates a mineral substance interpreted as a special kind of glass, the other that even designates a species of hyena!⁷⁰ No link seems thus to connect the different meanings that the term(s) *būšu* assumed throughout the 2nd and 1st millennia BC, except for the hypothesis that such dissimilar *realia* shared some feature able to give them something in common. Partridges have a yellow-brownish plumage and striped hyenas promenade a shaggy coat of the same golden colour but this is not enough.⁷¹ In the attempt to find a possible etymon of the superfine fibre denominated byssus, it could be useful to analyse more in detail the meaning and the contextualisation of homonymous nouns.

At least in a text the term *būšu* is preceded by the determinative for plants GÍŠ. It is, hence, a matter derived from a natural resource belonging to the plant kingdom and probably related to another term, the *bušinnu*.⁷² With the word *bušinnu* it indicated a fibre of extremely poor quality used in oil lamps as wick. Since the term also indicates a plant, it is likely that this fibre was of vegetal origin.⁷³ This plant has been identified with *Verbascum thapsus*, the common mullein, a grass used until modern times in Mesopotamia with the same purpose, but many scholars believe that wicks were made from the waste of linen, too short to be spun.⁷⁴ Actually in the Bible the term for wick (Heb. *pištâ/pēšet*) denotes the raw fibres from flax (*Linum* sp.).⁷⁵ Therefore, the term *bušinnu* could be linked with the precious fibre denominated *būšu* with flax and linen once again, as has already been argued by many scholars since the translation of the Rosetta Stone. It is, however, hard to understand why and

how this semantic shift happened. What is the connection between the humble material used in twisting wicks and the gorgeous fibre worn by king, high priest and gods?

Is it possible that raw byssus resembled in some way the tufts of vegetable fibres used inside the oil lamps, at least since the Bronze Age?⁷⁶ Supposing that *Pinna* sp. was already exploited for its byssal threads in textile production before Late Antiquity. It is interesting to note that several Italian dialects used terms (*funixedda*, *canapella*, *streppone*, *zocca* “string, little thread”) semantically related to the term *stoppa* “tow” and its derivative *stoppino* “wick” to mean exactly the blue mussel’s byssus.

However, within the cuneiform documentation of the 2nd and 1st millennia BC, other terms deserve to be further explored to look for other possible denominations of sea silk. In addition to the paraphrases discussed previously, the Akk. *imbû* (Sum. KA; KA.GÍR) attested in the second half of the 2nd millennium BC in the Hittite documentation, denotes both “the shaggy fibre on the trunk of the palm tree” (gišKA.GIŠ.SAR-gišimmar/giš KA.GÍR-gišimmar), and a mineral/vegetal matter from the sea/Mediterranean (Sum. NA4 KA; (Ú) KA A.AB.BA = Akk. *imbû tâmtim*).⁷⁷ If the marine “mineral” in question were identified with a shell, it would be possible to propose that the pen-shells hide behind the denomination *imbû tâmtim* because in the Mediterranean countries the large mussel is used for the production of both sea silk and nacre.

The end of the skein? (E.S.)

During the 1st millennium BC *byssus*, *byssos*, *bûš*, *bš* and *bûšu* were often connoted in the texts as a vegetal matter rather than as the secreted animal fibre produced by the Mediterranean pen-shell. Scholars interpreted quotes of these terms as a mention of superfine quality of linen or, as several others proposed, as cotton or silk.⁷⁸ During the 2nd and 1st millennia BC and over, linen had the highest economic and cultural value among fibres. It was cherished for the fineness, the lightness and the whiteness of the fabrics made from it. Sea silk shares with it, thinness and brightness. Furthermore, sea silk is much rarer than linen and, into the bargain, it shows golden tints, a colour worthy of kings and gods. These arguments are perhaps able to explain the translation of Greek *byssinon* as “king’s linen” in the Rosetta Stone, as well as the modern names of *seta marina* “sea silk” and *lana-penna* “wool from pen-shell”, still used in the areas of the Italian Peninsula where the fibre was collected and manufactured.

Contextualisation of the Semitic terms *bûš*, *bš* and *bûšu* suggests that already in the 1st millennium BC they could denote not only the finest textile recorded in the texts but also a golden, western and, perhaps, marine fibre. Nevertheless, it is worth recalling that in Iron Age Eastern Mediterranean and Mesopotamia, the wild silk or the wool dyed with saffron or safflower were used and they too

are precious and rare fibres showing a wide range of the golden-yellow colour.⁷⁹

As regards the Bronze Age, archaeological findings of *Pinna* shell remains, often broken into fragments do not prove *per se* the exploitation of the mussel for the production of fibres to spin. Until recent times the fan-mussel was gathered also as food.⁸⁰ Moreover among Mediterranean shells, *Pinna nobilis* and *Pinna rudis* provide the greater quantity of the mother-of-pearl used in inlay works and jeweller's craft. On the other hand, among many vernacular terms used to name the mussel, in Southwestern Sardinia, the last place in which sea silk is still worked, *nacchera* is the favourite one. The word is related to the En. *nacre*, Fr. *nacre*, Sp. *nácar* and, most likely, to the Semitic root *nqr* "to dig; to engrave". In Akkadian, the verb *naqāru* means "to hew out, to carve, to cut (stone), to incise". This etymology could be explained by the habit of the fan-mussels to dig sand with their foot with which to anchor themselves or otherwise with the inlay craft itself.⁸¹

Yet, until sea silk fibre will be found inside a spindle-whorl it is not possible to understand whether the economic importance of *Pinna* in the Late Bronze Aegean, attested to by archaeomalacological data and perhaps its cultural value testified by the fresco from Mycenae, was linked to its exploitation in the textile industry rather than to the inlay handicraft or even to its consumption as a food resource.

Regarding the terminology of the Bronze Age, cuneiform texts are quite ambiguous. Periphrases as the afore-said SÍG ҒA-ZAR-TUM A.AB.BA or KA A.AB.BA (= *imbū tâmtim*) suggest the exploitation of a marine resource for the production of fibres. In its turn, the sign KA is very interesting since it could reveal unexpected connections with the later word *būšu*.

Read as kir/ kir4/ kiri3 and preceded by the word for hair and wool (SÍG), the sign KA is used with the meaning "hair of the nose, greenish fibre" to indicate *ḫaṣartu*, presumably a Mediterranean or even marine fibre that is quoted in Hittite texts and in the Nuzi and Ugarit texts besides other coloured textiles. The same sign occurs with the meaning "fibre" also as a component for the noun indicating the vegetal hair of the palm date (Sum. giš KA.GIŠ.SAR-gišimmar; Akk.*imbū*). Moreover, the *imbū* is sometimes qualified as KA A.AB.BA a mysterious marine matter considered both a vegetal and mineral resource.



Cuneiform sign KA:

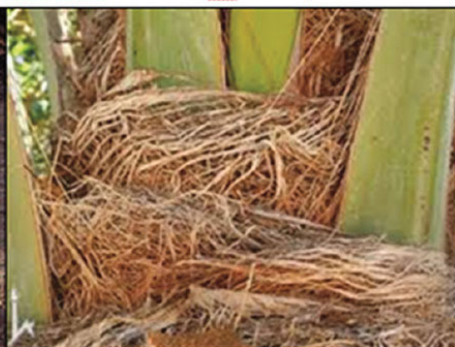
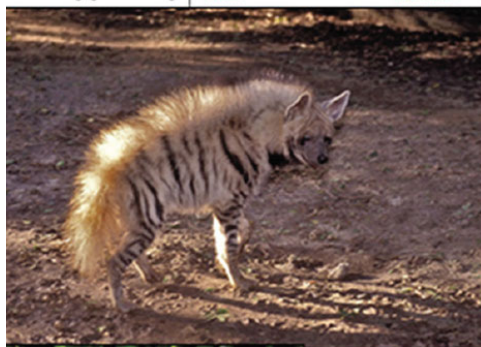
kir/ kir₄/ kiri₃ “nose, muzzle”;

kir/ kir₄/ kiri₃ “hyaena”=Akk. *būšu*;

zú, su₁₁ “date palm fiber”

=Akk. *imbū*;

NA₄ zú “flint”;



(Ú) KA A.AB.BA = *imbū tâmtim* “palm-fiber of the sea”?

NA₄ KA A.AB.BA = *imbū tâmtim* “flint of the sea”, nacre?

HA-ZAR-TUM = *hasartu* = SĠG KA
“hair of the nose, dry mucus,
yellow-greenish wool”

SĠG HA-ZAR-TUM A.AB.BA “green-brownish fiber from the Mediterranean Sea, i.e. sea-silk”?

Fig. 4.5. Top: different meanings of the Cuneiform sign KA. In the middle, on the left: the Near Eastern hyena indicated by the reading kir⁴/kiri³ (Akk. *būšu*); in the middle, on the right: the fibre from date palm tree indicated by the reading zú/su¹¹ (Akk. *bušinnu*). Below, on the left: sea grass and its fibre maybe indicated by the wording KA.A.AB.BA (Akk. *imbū tâmtim*); below, on the right the golden brownish byssal threads of *Pinna nobilis*, very similar in colour and appearance to the tufts of hairs of *Hyaena hyaena* and to the sheath at the base of *Phoenix dactylifera* leaves (graphic elaboration: E. Soriga).

Since the early 2nd millennium BC, the sign KA is then used to indicate the striped hyaena, no doubt for the ambivalence of Sum. kir/kir₄ and Akk. *appu* meaning both “nose” and “snout”, the most striking peculiarity of this ferocious animal.⁸² The Akkadian equivalent of the word, *būšu* “hyaena” occurs for the first time in the Standard Babylonian Epic of Gilgamesh, written around the 9th or 8th century BC, thus in the same period in which Akkadian texts quote for the first time *būšu* “byssus” as the most precious among fibres (Fig. 4.5). It is

not clear which one of the two homonymous terms had influence on the other. Nonetheless, both seem to point to the presence of blonde-brownish woollen tufts of hair. Indeed, the striped hyaena shows a yellow-brownish coat with a luxurious mane of long hairs along the back from the occiput to the base of the tail.

A possible relation of the word *būšu* “byssus” with the noun *bušinnu* “wick, plant for the wicks” has been already discussed previously where the word has been linked to the waste of linen. Nevertheless, lexical texts translate *bušinnu*-plant as (Ú) *gis-gi-zú-lum-ma*, literally a “date palm tree” and make an equivalence with the Akkadian phytonym *gišlammu* “a kind of reed, lit. date-reed”.⁸³ Other Sumerian written variants of the phytonym are *gis-bu-ši-in*, namely the Sumerian calque of Akkadian *bušinnu*, and *gis.BU-zú-lum-ma*, a name that suggests a possible derivation of the Akk. *bušu* from the Sumerian sign BU a possible reading of which is *gi/gíd* “to become long, to lengthen” and the sign ZU, the reading of which, *su11*, has the meaning of “palm fibre”.⁸⁴ These philological suggestions seem to be confirmed by the archaeological find of a wick made of palm fibre in the nozzle of an oil lamp in the 1st century BC Qumran, Israel (Fig. 4.6).⁸⁵ Therefore it is more than probable that KA and *bušinnu* (*kir/kir4/kiri3* but also ZU, *su11*) denoted the twine of golden-brownish hair used as wick for the lamps. Since the Greek and Latin terms for byssus derive from the Semitic language but sea silk is a Mediterranean commodity, it is reasonable to think that originally the Akkadian *būšu/bušinnu* denoted the clusters of the palm date tree from which wicks were obtained. Our theory is that only later, around the 9th–8th centuries BC, *būšu* started to indicate, by analogy to the colour of the hair, the precious fibre denominated byssus and, the striped hyaena.

Conclusions (E.S. and A.C.)

Considering the available data for the 1st millennium BC we can extrapolate some conclusions:

- *būšu* indicated the striped hyaena, characterised by a long yellow-brownish mane.
- *būšu* indicated a superfine fibre (byssus) that often was imported from Mediterranean coastal cities or from places sited along the main trade routes for the sea.
- *būšu* is also listed besides marine resources as fish, coral, marine purple-dyed textiles or typical western commodities.
- the use of byssus in place of golden fibres and threads in some clothes paraded as attributes of power suggest that its colour was yellow-brownish, thus fitting with the amber colour of the sea silk.
- the possible analogies between *būšu* and its homonymous terms could corroborate the aforesaid suppositions about the shade of colour of this fibre, as

similar to the colour of the palm-fibre and to the coat of the striped hyena.



Fig. 4.6. “Herodian” oil lamp with palm-fibre wick still in the nozzle. From Qumran (1st century BC–1st century AD), in Sussmann and Peled 1993, 94, Fig. 15.

For the second half of the 2nd millennium BC the data allow us to affirm that:

- Some Late Bronze Age texts from Bogazköy record two different paraphrases interpretable as sea silk: “green-yellowish wool from the sea” and “marine palm-fibre/wick of the sea”.
- Some of these texts quote SÍG ḪA-ZAR-TUM A.AB.BA “green-yellowish wool from the sea” among the commodities exchanged between Mycenaean and Hittites.
- Archeomalacological data show for the same period an intense increase in the exploitation of pen-shell in several Mycenaean sites of the Peloponnese and Attica.
- The interpretation of a fresco from Mycenae suggests that the pen-shell had an important cultural role at the site and was probably involved in Mycenaean rituals.
- The sign KA (= zú, su 11) denotes a kind of hair. It is used to indicate both the brownish date palm leaf sheath fibre used to make wicks in Mesopotamia and an ambiguous marine matter (Sum. KA A.AB.BA; Akk. *imbū tâmtim*).
- Although the cuneiform texts circumscribed its use to medicine,⁸⁶ the terms *imbū tâmtim* may denote a marine fibre similar to the wick used in Mesopotamian oil-lamps (*bušinnu*; KA) extracted by the palm tree (*gis.BU-zú-lum-ma*).
- In Cuneiform texts, determinative signs qualify *imbū tâmtim* “marine palm-fibre”/wick of the sea’ sometimes as a plant, otherwise as a stone. The only marine resource able to provide both brownish fibres (sea silk) and a mineral substance (nacre) is the pen-shell.

These data support the hypothesis according to which during the 1st

millennium BC the Akk. *būšu*, Heb. *būš*, Ph. *bš*, Gr. βύσσος and Lat. *Byssus* could indicate something quite different from a vegetal fibre, namely a first-rate quality of flax. The analysis of the texts in which the terms occur strongly suggest that it was a fibre typical of the Mediterranean Basin, most likely a marine resource, characterised by a colour linked to the royal ideology, perhaps resembling the colour of the palm-date fibre. Among the possible candidates for the identification, sea silk seems to fit the most. The difficulty of sea silk manufacture may explain the scarcity of the term in the Cuneiform documentation, beside the persistent use of linguistic devices as metaphors and catachresis still attested to today. Therefore, if byssus was the same fibre later named sea silk, it is probable that it was not a mass-produced commodity but was worked only for special occasions.

Regarding that and with reference to the Bronze Age, the attestation of some periphrases that denote a yellow-greenish fibre from the sea, would suppose that sea silk was at least known, if not systematically gathered and worked. In last quarter of the 2nd millennium BC, archaeomalacological data show a significant increase of pen-shell exploitation in the Mycenaean economy. Moreover, the iconographical representation of two fan mussels in the fresco from Mycenae suggests that the mollusc acquired a certain cultural importance too. The coeval Hittite texts indicate that SÍG ḪA-ZAR-TUM A.AB.BA was an import obtained through international exchanges with Aegean communities.

In the absence of further archaeological, archaeomalacological and epigraphical data it is, however, too difficult to claim that this fibre was incontrovertibly sea silk.

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Abbreviations

AfO (aka AfK)

Archiv für Orientforschung (vols 1–2
as AfK = Archiv für
Keilschriftforschung, Berlin . . . Wien
1923 ff.); Beih. = Beiheft (1933 ff.).

BAR

British Archaeological Reports.

ARMT	Archaeopress. Oxford. Archives royales de Mari (Transcription, traduction, commentaire). Paris
CAD	The Assyrian Dictionary of the Oriental Institute of the University of Chicago. Chicago 1956.
CDA2	J. Black, A. George and N. Postgate (eds), <i>A Concise Dictionary of Akkadian</i> , 2nd (corrected) printing. Wiesbaden 2000.
IBoT	Istanbul Arkeoloji Müzelerinde bulunan Bogazköy tabletleri. Istanbul.
KBo	Keilschrifturkunden der Vorderasiatisch-ägyptischen Gesellschaft. Leipzig.
KUB	Keilschrifttexte aus Bogazköy. Berlin 1916.
MEE n.	Materiali epigrafici di Ebla. Roma. note of the author.
NABU	Nouvelles Assyriologiques Brèves et Utilitaires (Paris 1987 ff.); cf. Mémoires de NABU (1992 ff.), Cahiers de NABU (1990 ff.).
PBS	University of Pennsylvania, Publications of the Babylonian Sectio. Philadelphia 1911.
SAK (SAKI)	F. Thureau-Dangin, Die sumerischen und akkadischen Königsinschriften (= VAB I, 1907).

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¹See Burke 2012, 2: “At least 20 different species of related molluscs produce

fibers, but *Pinna nobilis* is the most common and yields the finest fibers”. For the *Pinna rudis* see Brunello 1968, 58 and 470. Whereas *Pinna nobilis* is readily found along the shallow shores of the whole Mediterranean Sea, *Pinna rudis* is more typical of the Aegean and the Eastern Mediterranean rather than of the Red Sea as reported by the author.

2 Since 1992 the *Pinna nobilis* is listed as an endangered species and is currently under strict protection in the Mediterranean and all forms of deliberate capture or killing of fan mussel specimens are prohibited by law.

3 The little village of Calasetta (Câdesédâ in Tabarkin, the Genoan dialect still spoken) probably takes its name, meaning “Cove of the Silk”, from the bay in which pen-shells were fish-farmed for the production of the sea silk worked in Sant’Antioco. Locals call Cussorgia “the Graze”, the cove where *Pinna* grows.

4 Maeder 2008; McKinley 1998, 52.

5 Maeder 2008 no, 111: “ *Nec fuit satis tunicam pangere et serere, ni etiam piscari vestitum contigisset; nam et de mari vellera, quo mucosae lanositatis lautiores conchae comant* ”; McKinley 1998, 52 translates: “Nor was it enough to comb and sow the materials for a tunic. It was necessary also to fish for one’s dress. For fleeces are obtained from the sea, where shells of extraordinary size are furnished with tufts of mossy hair”.

6 Rocci 1993, 764 sub ἐπlov “lana”: “filamento di conchiglia; se ne tessono anche guanti”.

7 Another Chinese name for sea silk was *chiao-hsiao* “mermaid fleece”, McKinley 1998, 67–74.

8 Marzano 2013, 169.

9 For a comprehensive review of the occurrences of the term in the Classical sources see Maeder in this volume. For the attestation of the related Semitic terms in ancient Near Eastern documentation see Oppenheim 1967.

10 The only link to the sea could be provided by the relation between the Ancient Greek terms βύσσος “byssus”, i.e. a fibre of finest quality, and βυσσός (= βυθός) “depth, bottom of the sea”; the adverb βυσσόθεν has the meaning of “from the seabed”, Rocci 1993, 371; see also McKinley 1998, 23.

11 See also Maeder this volume.

12 Oppenheim 1967.

13 Leviticus XIX, 19; Deuteronomy XXII, 11; 1 Chronicles XV, 27 refers on the entry of the King David in Jerusalem with the Ark of the Covenant. He dressed a long tunic in byssus (*mě ‘il bûš*) as well as all Levites who brought the Ark. In Exodus XXXIX, 3 the *ephod* (a long ceremonial dress) for Aaron was made of gold, blue and red purple, scarlet and *bûš* , Gleba 2008, 61. P. Sroka (1995) rejected the identification of the Israelite byssus with sea silk since the use of a fibre from molluscs for priest clothing and other liturgical textiles would be in contradiction with the imperatives of purity. F. Maeder (2008, 113) denies this

opinion, since molluscs shall be “impure for dietary, but not for textile purpose”.

14 CAD B, 350 sub *būšu* D ‘byssus’; CDA 2 , 50.

15 This intrinsic feature made sea silk a very rare and attractive raw material and therefore a subject worthy of forgery. In the 4th century AD Basil of Caesarea stated “How can the Pinna shell produce her fleece of gold, which no dye has ever imitated?”. See McKinley 1998, 54.

16 2Chronicles II, 13–14; 2 Chronicles III, 14; Eshter I, 6; Eshter VIII, 15; Ezekiel XXVII, 16. Care should be taken when looking for the occurrences of byssus in the modern translation of the Bible: in the Italian translations the word *bisso* ‘byssus’ is found with coloured textiles also in Exodus XXV, 4; XXVI, 1, 4, 31, 36; XXVII, 16; XXVIII, 5–8, 15, 28–33, 37; XXXV, 6, 23–25, 35; XXXVI, 8–11, 35–38; XXXVIII, 18, 23; XXXIX, 1–5, 24 and 27–29 but it is not a translation of Heb. *būš* ! Regarding this see Maeder this volume.

17 See also Brunello 1968, 56.

18 Oppenheim 1967, 249; For the *tabarru* wool see Soriga in this volume.

19 Maeder 2008, 110 and 112, fig. 3.

20 Pinnock 1992; Pasquali 1997, 262–267; 2010.

21 Pasquali 1997, 262–267.

22 Pasquali 2010, 180.

23 ARMT XXIII, 202: about *ṭi-wi-it gada a-na sagšu-ḥá ša ḥuš-a*. See Durand 2009, 173 and Pasquali 2010.

24 Waetzoldt 2010 states that *ḥuš-a* wool is perhaps the only coloured wool obtained by dyeing it. Regarding the natural resources used from which dyestuff was extracted see Soriga 2013.

25 Pasquali 2010; 1997, 232: *túg-ḥuš-a* “habit à broderies”. A *lamaḥuššû* “a precious garment made of wool” (CAD L 58, sub *lamaḥuššû*) was sent to the king of Mari after his departure; see Durand 2009, 57 and n. d). The use of the term *šûturum* “ *chic, de luxe* ”, a fine garment quoted in Mari among foreign fabrics, as a gloss for *lamaḥuššû* can suggest that “il devait s’agir d’un item en usage dans l’Ouest”, Durand 2009, 120. See also Waetzoldt 1972, 51 and Waetzoldt 2010.

26 CAD H, 261–262 sub *ḥuššu* . See also Durand 2009, 130 about the fabrics *ḥuš-a* “ *en or rouge* ”.

27 Furthermore, headgears of ‘golden’ textile continued to be used as an attribute of power and royalty until more recent times. In St Denis, near Paris, archaeologists found a headgear woven in sea silk, dated back to the 14th century AD. See Maeder 2008, 110 and 112, fig. 3.

28 Oppenheim 1967.

29 Oppenheim 1967; Brown 1995, 209.

30 Ezekiel XXVII, 16. With respect to the historical context of this Biblical pass see Soriga this volume.

31 Oppenheim 1967.

32 Tel Ashdod was Judah's closest Mediterranean harbour and the most important centre of the cult of Dagon, later interpreted as the Philistine Fish-God who protected sea trade. During the period of Sennacherib, Ashdod-Yam "Ashdod of the Sea", one of the two docks of the older city, absorbed its function.

33 Oppenheim 1967.

34 Oppenheim 1967.

35 Jones 2010, 89.

36 Michel and Veenhof 2010, 246.

37 Vigo 2010, 291. KBo XXVIII 47; KBo I 29 + KBo IX 43; KUB XXXIV 2.

38 Edel 1974, 120.

39 Zaccagnini 2000, 441.

40 Heinhold-Krahmer 2007. I am very grateful to Felicitas Maeder for indicating this important source to me.

41 Heinhold-Krahmer 2007, 200 and n. 110.

42 McKinley 1998, 80–81 also refers to the later (10th–13th centuries AD) use between Arabic and Jewish people to fancy byssus as wool obtained from a water sheep, from sea-monsters and finally from a large marine mollusc.

43 Goetze 1956, 34–35.

44 Goetze 1956, 34–35; see also Košak 1982, 4–10.

45 Heinhold-Krahmer 2007.

46 *Contra* Landsberger 1967a, 139: "Grün-Blau = Dunkelfarbig-keit (*aḥḍar*)".

47 CAD H, 130 sub *ḥaṣartu* . For Ugarit cf. Matoïan and Vita 2014, 319 and nn. 104–105: " *ḥaṣertu* 'green(?)', 'yellowish-green(?)' ". The text RS 34.180, 4, rev. 3' mentions *ḥa-še-er-ti* and could be a tribute-list written at Hattuša, see Matoïan and Vita 2014, 319, nn. 104–105. Note that in IBOT I 31 this kind of wool was instead imported to Boğazköy from the Aegean. Maybe this colour of wool could be related to the plant *urṭû* , a plant which produces a brownish or blue-greenish dye colour (Malku VI 179f, *ur-ṭu-u*, *ḥinziribu* = *ḥaṣ* [*mānu*] ; see CAD U 256, sub *urṭû* Awhere the word is attested "in the Nuzi corpus by a single occurrence", Abrahami 2014.

48 CAD H, 130 sub *ḥaṣartu* ; CAD AII, 185 sub *appû* A: *síg.kir* 4 .mu = *ḥa-an* (var. omits) -*za-ar-ti ap-pi-ia* "the hair of my nose".

49 Heinhold-Krahmer 2007, 200 and 202–203.

50 CAD AI, 221 sub *ajabba* ; Horowitz 1998, 302303.

51 During the 1st millennium BC Aristotle (*HA* , XIX, 6). Pliny (*HN* , XI, 25–75

and 27, 76–78) mentioned silkmoth and fabrics woven with the threads unwound from its cocoon. L. Oppenheim (1967) suggests that the Assyrian silkmoth mentioned by Pliny was traded in Mesopotamia through the northern Syrian city of Babyke. Nevertheless, although Strabo identified *byssos* with silk (Geog . XV, 1. 20), in the Book of Revelation (XVIII, 12) both animal fibres are quoted beside purple and crimson-dyed wool among the treasures of Babylon. This mention excludes the possibility to identify byssus with silk (see Soriga 2013). Mediterranean silkworms produce a fibre that shows darker blond colour and coarser texture than the silk of the mulberry moth, since they feed on the leaves of plants rich in tannins as *Cupressus*, *Juniperus*, *Thuja occidentalis* . *Quercus pubescens* and *Pistacia* spp. The discovery of a cocoon of *Pachipasa otus* (Santorini, Cyclades) and of fibres of wild silk from *Tortrix viridana* (Pyrgos-Mavroraki, Cyprus) at some archaeological sites of the Eastern Mediterranean, date back the 2nd millennium BC and fit with the numerous representations of sericigenous moths such as *Saturnia Pyri* in the coeval iconography. See Panagiotakopulu *et al* . 1997; Panagiotakopulu 2000, 70 and 86–94; Lentini 2004, 37–47.

52 See Soriga (in this volume) and the related bibliography.

53 Archaeomalacology may just reveal the possibility of a sea silk exploitation at a site carrying on the analysis of the shell remains by means of a taphonomical approach. Only shells that show neither marine erosion traces nor internal biofouling nor internal bioerosional marks could be collected still with their byssus. Nevertheless, this does not exclude that the molluscs were used only as food. Unfortunately, archaeomalacological papers that report an accurate taphonomical analysis of *Pinna* remains are regrettably rare.

54 In Andalusia at Chalcolithic Los Millares (Boessneck 1990); in Sardinia at Neolithic Cuccuru is Arrius, where 161 remains have been found (Bignon *et al* . 2008); in Sicily at Middle Neolithic Megara Hyblaea (see Villari 1995, 384); in Macedonia at Late Neolithic Dikili Tash (Karali 1992, 152) and at Neolithic Stavropoulis, where 441 remains have been found (Karali 2005, 94); in Thrace at Neolithic Lafrouda mound (Ammerman *et al* . 2008); in Attica at Neolithic Kitsos cave (Chevallier 1973; 1981); in Euboea at Neolithic Tharrounia (Karali 1999a, 55); in the Argolid at Neolithic Lerna (Reese 2015a); in Cyclades at Neolithic Kephala on Kea Island (Coy 1977, 133); in Crete at Neolithic Malia (Karali 1999a, 55) and Neolithic Petras (Theodoropoulou 2012); in Cyprus at Late Neolithic Paralimni-Nissia (see Reese 2008a).

55 Karali 2005a, 94.

56 In Italy, they have been found in Sardinia at Nuraghe Palmavera, near Alghero (Taramelli 1904) and at Nuraghe Cuccurada-Mogoro (personal analysis), in the Marche at Colle dei Cappuccini (Wilkins 1990) and in Apulia at Punta Le Terrare, Torre Santa Sabina and Monopoli (Wilkins 1991) and at Coppa Nevigata, where 31 remains attest the importance of such resources

(Minniti 2001).

57 In Macedonia at Kastanas (Becker 1986), Mesimeriani (Karali 2002), at both Kastrì and Skala Sotiros sites (174 remains) on Thasos Island (Karali 1999a, 55; 1999b) and at Ayios Mamas, where C. Becker 1996 notes that many fragments come from large size specimens collected alive and probably used in the diet. In Boeotia at Glas on Lake Kopais (Iakovidis 2001, 123). In Attica at Eleusis (198 remains, 87% from Late Helladic III phases in Cosmopoulos *et al.* 2003), at Kolonna on Aegina Island where 740 remains have been found attesting the importance of this species in the site, (data collected by Prof. Gerhard Forstenpointner (Vienna) and his students – David S. Reese, pers. comm. March 2012). In Euboea at Lefkandi (16 remains, one with vermetid inside and another artificially shaped as spoon or palette suggesting here the shells were collected as raw material; Reese 2006a). In Corinthia at Perachora on Vouliagmeni lagoon (David S. Reese, pers. comm. March 2012). In the Argolid at Asine, Midea (from Late Helladic III strata) and Mycenae (37 remains, mostly from LHIII contexts) (see Reese 1998a) and at Lerna (165–171 remains from all the Bronze Age strata), where Gejvall (1969) and Reese (2008b; 2013a; 2013b) report a growing trend toward the LH III. In Achaea at Helike (Karali 2011). In Messenia at LH III Nichoria (Reese 1992, 774) and in the Palace of Nestor at Pylos, where four of the 15 remains were worked as inlay or earrings, according to Ruscillo (2010). In Laconia at Ayios Stephanos (26 remains, half of the Bronze Age ones from LH III strata; Reese 2008c). In the Cyclades at Ayia Irini on Kea Island (Coy 1986, 111), at Akrotiri on Thera (Karali 1990) at Saliagos islet, near Antiparos Island, where 462 remains from very huge specimens have been found and two worked to produce a plaque and a spatula (Shackleton 1968, 126–127). In the Sporades at Thermi on Lesbos (Lamb 1936, 217), at Poliochni on Lemnos (94 remains with some fragments holed and smoothed on the sides to produce quadrilateral plaques (Bernabò Brea 1964, 51–52; Karali 1993; Sorrentino 1997). In Crete at Knossos (Reese 2015b), Pseira (Reese 1998b), Palaikastro (Reese in press), Ayia Triada (Wilkens 1996), Kommos (Reese 1995; Ruscillo 2012), Malia, where some rectangular worked inlays were found (Karali 1993, 46), Petras (Theodoropoulou 2012), Mochlos (Soles *et al.* 2008) and Kavousi Vronta (David S. Reese pers. comm. March 2012). In the Aegean Turkey at Troy and Beşik-Yassitepe (Von den Driesch 1999) and at Bakla Tepe, Liman Tepe and Panaztepe (Reese 2006b).

58 Hala Sultan Tekke, see Demetropoulos 1979, 139 and Reese 2007; Marki-Alonia, see Reese and Webb 2006; Pyrgos-Mavroraki (a worked umbo bored at the centre) (Carannante 2009; 2010). Some *Pinna* remains also from Late Chalcolithic Erimi-Pampoula (Wilkins 1953).

59 Belgiorio 2009.

60 For more details, see previous notes.

61 Lefkandi on Euboea, Pylos in Messenia, Saliagos Islet near Antiparos,

Poliochni on Lemnos and Pyrgos-Mavroraki on Cyprus.

62 E.g. Skala Sotiros on Thasos, Eleusis, Kolonna on Aegina, Lerna, Saliagos near Antiparos, Poliochni on Lemnos.

63 Midea, Mycenae, Lerna, Ayios Stephanos, Nichoria, for details see previous notes.

64 Late Helladic III period (about 1400–1050 BC) is just a part (a tenth) of Greek mainland Bronze Age (3200–1050 BC). The considerable increase of remains in such period is hence more significant.

65 Gejvall 1969, 7; Reese 2008b; 2013a, 2013b; 2015.

66 Taylour 1983, 56.

67 Burke 2012.

68 Doneddu and Trainito 2005, 191.

69 CAD B, 349 sub *būšu* C; CAD I/J, 207 sub *iššūr hurri* .

70 CAD B, 348–350 sub *būšu* . Cuneiform tablets refer also about a “land of the *būšu* ” (*šadê bu-ú-ši / māt E-bu-ú-ši*) but this geographical name could be derived from any of the four homonyms and therefore it’s not possible to link this quote with the Biblical reference of the byssus workshops in Beersheba.

71 The striped hyaena (*Hyaena hyaena*) is common in Near East up to the Mediterranean shores and Turkey.

72 CAD B, 349 sub *būšu* B, 3’, KAR 307, 32: “the middle heaven is of *saggilmut* stone and belongs to the (other) Igigi gods, the Lord took up residence in it on a sublime dais, on a dais of lapis lazuli «GIŠ» *bu-ši elmeši ina libbi unammir* he made it shine within with *bušu* glass and crystal”. See *contra* Landsberger 1967a, who interpreted the sign for *būšu* as GIŠ *bu-ši-* [*in*] (*bušinnu*), translating the same passage as “(der Herr hat...) eine Lampe aus Bernstein entflammt” (“the Lord kindled a lamp in amber”). For Akk. *bušinnu* , see the further discussion.

73 CAD B, 348 sub *bušinnu* . Oppenheim 1967, 251 n. 83: he already proposed “a possible relationship between *bušu* and the word for ‘wick’, *bušinnu* , without suggesting an etymology, in view of the possibility that wicks are by nature made of fluffy plant fibers, so that the fineness and fluffiness of the material would form the link between the two words”.

74 CAD B, 348 sub *bušinnu* ; Landsberger 1967b, 39–40, n. 141 however rejected this identification: “‘Verbascum’ has little probability because *b* . is a tree (giš-gi) ‘bamboo-like’ or GIŠ.GÍD ‘willow-like’, because verbascum does not grow in Mesopotamia and though used by the Greeks for wicks, is not within the geographical orbit of”. For linen wicks see Peyronel 2004, 31.

75 Isaiah XLII, 3; King and Stager 2001, 147–150. See also Maeder this volume.

76 Note that in several Italian dialects the mussel’s byssus is called *funixedda*, *canapella*, *streppone*, *zocca* . All these terms, semantically related to the term

stoppa “tow” and to his derivative *stoppino* “wick”, mean “string, little thread”.

77 CAD I / J 108–109, sub *imbû* A. See also Landsberger 1967b, 41 who claims: “the meaning of *imbû* has to be extended to the buds of leaves and flowers protected by the fiber”. At n. 145 he states: “...we dismiss the etymology offered CAD U/J 109 and only consider that *imbu’ tâmti* is between a mineral and a plant”. CDA 2 , 128 translates *imbû* (*imbu’u*) as ‘algae, scum’ on sea.

78 See also Maeder this volume.

79 Soriga 2013.

80 Athenaeus of Naucratis (*Deipnosophistae* , 1: 277; 373, 379; 385; 395; 2: 95) mentions this kind of consumption in the 3rd century AD, see Burke 2012.

81 CAD N/I, 331 sub *naqāru* ; the Neo-Ar. *naqqārah* is perhaps linked with this root too. It is a military kettledrum brought in Andalusia (*nácra*) by Arabians, originally decorated with mother-of-pearls and usually played in pairs (Corriente 2008, 392, 395). In Italy, *nacchera* denotes an idiophone instrument similar to the castanets: it consists of a pair of concave shells joined on one edge by a string that remind the two valve of a big mussel. This instrument is called ὄστρακα already in Aristophanes, *Batrakhoi* , 1305 since it was made with bivalves (Gr. ὄστρεον “shell, oyster”).

82 CAD A/II, 185 sub *appu* .

83 CAD G, 104 sub *gišlammu* : “Since *bušinnu* means ‘wick’, one may assume that the woolly inflorescence of the *gišlammu* reed was used for manufacturing wicks for oil lamps”.

84 Akkadian terminology could confirm the use of the palm fibre in the manufacturing of wicks: *pitiltu* , a synonym for *bušinnu* derives from the verb *patālu* , that designates “the twisting of ropes (occasionally also wicks) in all Semitic languages ... Attempts to extend the content of *patālu* in several directions must be refused”; see Landsberger 1967b, 22, n. 62. CAD P, 435–436 sub *pitiltu* ; Potts 1997, 126–128; Landsberger 1967b, 6–7 and 21–30. For the use of the sign KA as abbreviation of KAxSA “palm fibre” see Greco 2013.

85 Sussmann and Peled 1993, 93 and 94: 15.

86 CAD I / J 109, sub *imbû* A; Landsberger 1967b, 41–42.

Finds of *Pinna nobilis*, *Hexaplex trunculus* and evidence for specialized textile production in Aetolian Chalkis

Sanne Houby-Nielsen

for Kaj

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The hill of Agia Triada is located on the Aetolian coast directly opposite the city of Patras. The earliest habitation dated to the Early Bronze Age and lasted to the Late Bronze Age period (Early Helladic–Late Helladic III C), when the site was temporarily abandoned. In the first quarter of the 7th century BC (corresponding to the so-called Late Proto-Corinthian/Early Middle Proto-Corinthian period), a new settlement was founded. Greek-Danish excavations revealed evidence for buildings situated on terraces outside an Archaic wall which encircled the summit of the “acropolis”. This terrace-settlement continued during most of the Archaic period, but appeared especially to have flourished in its early phase and primarily to have consisted of workshops specialized in the production of fine textiles. The main character of the pottery was distinctly “Corinthian”, but was produced locally. In two areas, a succession of cultural strata was especially deep and undisturbed, with patches of floors and finds preserved *in situ*. One area was close to the ancient harbour, the other area was situated on the Eastern Terrace facing inland. In both of these excavation areas, loom rooms from the foundation-period were seen to have introduced new types of small loom weights (conical and pyramidal) weighing no more than 50–70 g and a kind of predecessor to spools (loom weight-spools). *Hexaplex trunculus* appeared in the very same strata as these weaving innovations and as ritual basins for water (*louteria*) and for grinding (*mortaria*). One or two generations later, during the so-called Middle Corinthian period, the same loom rooms introduced further innovations clearly used for textile production: spools, micro-blades with razor-blade sharpness and various small ceramic containers for “weaving kits”. In this second period of textile experimentation, *Pinna nobilis* appeared for the first time on the hill of Aghia Triada and in the very same contexts as these new weaving implements.

This paper will put forward the evidence for a specialized textile production and its connection with the occurrence of *Hexaplex* and *Pinna*.

Introduction

Between 1995 and 2001, Greek-Danish excavations uncovered remains of an ancient settlement on the hill of Agia Triada on the coast of Aetolia (Fig. 5.1). The site can be identified with “Chalkis hard by the sea” mentioned in the *Iliad* as one of five cities in Aetolia which contributed ships to the expedition against Troy (*Il* 2, 638–640). The small promontory lies at the modern fishing hamlet Kato Vassiliki in between two majestic mountains which functioned as important landmarks throughout antiquity. Chalkis is accordingly situated at the very entrance/exit of the Gulf of Corinth and its harbour would have been the last/first station on the Aetolian coast for ships communicating between the Corinthian gulf and south Italy. The promontory was inhabited in three main periods in antiquity: from the Neolithic to the Late Bronze Age, during the Archaic period and finally in the Late Classical to Hellenistic period. In the Early Byzantine period, a large basilica was constructed on the summit of the hill and protected with a fortification wall. Since then, the hill has been largely uninhabited.



Fig. 5.1. The small promontory of Archaic Chalkis is seen in the centre. The coast and city of Patras is visible in the background (photo: A. Andrén).

In total, excavations were carried out over a period of 30–36 weeks with a team of five or six technicians assisted by students and workers. Trenches were dug in several parts of the hill and a large number of wall structures, visible on the surface, were cleared, including long stretches of an Archaic “acropolis” wall which probably once enclosed the summit of the hill. The Byzantine fortification wall could be seen to follow the outline of this wall (Fig. 5.2). The majority of the movable finds soon proved to stem from the Archaic period,

starting in the early 7th century BC and ending in the early 5th century BC. In particular, deep cultural strata with Archaic material dating to the 7th century BC were found in trenches near the shores of the ancient harbour and on the north-eastern slopes of the hill. In the former area (the K-trenches), parts of 11 rooms were excavated many of which must have belonged to the same house (the “House at the Harbour” in Fig. 5.2), while in the latter area, a row of separate rooms was found which faced a broad road paved with stone slabs (loom rooms N-1, N-2, and N-3).

Large amounts of Corinthian pottery, mainly open shapes, came to light in the rooms. However, the present paper focuses on the recurrent find of fragments of the marine shells *Hexaplex* and *Pinna* in contexts with evidence for weaving/warping and for experiments to improve weaving technologies.

Around 155 small and homogeneous-looking Archaic loom weights and spools were found in well-defined, stratified contexts and in association with architecture. The loom weights came to light in almost all the trenches and were a recurrent feature in the survey of the hill conducted prior to the excavations. The number of spools and loom weight-spools (38) was smaller and their distribution more restricted. In contrast to the high frequency of *homogeneous-looking* loom weights, only thirteen objects were found in the entire excavation which with some degree of certainty could be identified as spindle whorls, and these few spindle whorls were of *different* shapes and weight. Obviously, most yarn must have come ready-made and was accordingly produced elsewhere. The overall impression was therefore that the loom rooms were intended for a specialized industry of very fine textile, possibly narrow borders, as opposed to a household production of various kinds of textiles. The find-circumstances further suggested that the *Hexaplex trunculus* was used for extracting colour and that experiments took place to make use of the byssus of the *Pinna nobilis* for gold-imitating threads. Such luxury fibre would be highly suitable for elaborate borders and decorative details.² The textile production was protected by a divinity of the acropolis who recalled the Athena Ergane cult in Troy and South Italy.

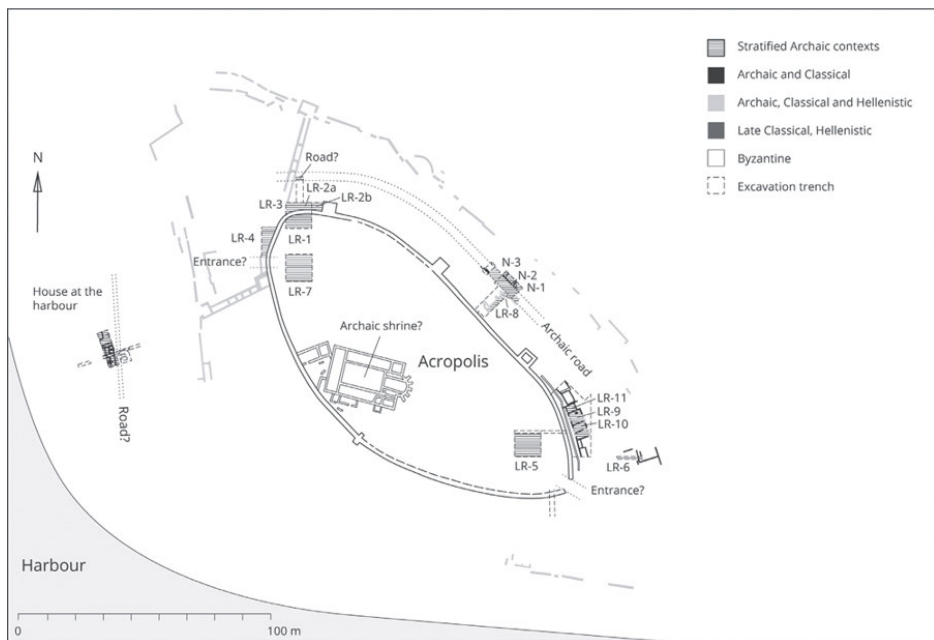


Fig. 5.2. The promontory of Archaic Chalkis with the basilica of Aghia Triada. An interpretative map of the main structures excavated between 1996 and 2001. Based on C. Marinopoulos (drawing: R. Toth).

The contexts of the shellfish; loom weights, spools and weaving kits

Fragments of *Hexaplex* and *Pinna* were found in contexts with implements and other evidence for a specialized textile production which was highly experimental and innovative. These contexts and implements are described in more detail in this section.

The loom weights consisted of two main categories both of which were possibly “invented” in Chalkis and both of which appeared already in the foundation strata:

- Small, finely shaped loom weights (pyramidal or conical) pierced horizontally near the top (lw). Those from the foundation strata of Chalkis are the earliest ones so far found in post-Bronze Age Greece in a stratified settlement context. The conical shape dominated in the foundation strata, while the pyramidal shape was preferred in the 6th century BC. Clearly, tests and experiments had gradually led to a “standard” loom weight.

- Small loom weights (pyramidal or conical) pierced horizontally near the top, but also equipped with a small indentation (circular or square) at the top. These small indentations may have held a stick for storage of excess thread. This kind of loom weights is here called loom weight-spools (lws) and is unique to Chalkis. In the foundation strata, all examples were conical and all came from one and the same loom. In 6th century BC strata (Middle Corinthian), all examples were pyramidal. Again, tests and experiments must have led to a

standard loom weight-spool.

Spools constituted a different category of implements, and they appeared later, namely in strata dating to the 6th century BC. These spools were never pierced and according to their find contexts, they served a different purpose than the loom weights, probably warping and storage of fibre. The spools came in different shapes and wares indicating that a lot of experiments took place to produce the most efficient kind. On present evidence, the loom rooms in Chalkis were the first ones to ‘invent’ or ‘adopt’ (probably from Italy) the use of spools, since finds of spools of this kind elsewhere in post-Bronze Age Greece either come from later or from disturbed contexts.

As seen in [Table 5.1](#), by far the majority of weights were loom weights (lw), while loom weight-spools (lws) and spools were less common. The majority of the loom weights weighed between 49 g and 95 g, some as little as 35–45 g, and loom weight-spools tended to weigh 50–65 g while spools weighed more (96–120 g).

The conical loom weights and some of the spools resembled examples from Corinth and the Corinthia. The spools also had isolated parallels dating to the Archaic period in Delphi, Elis, Kephallonia, and a few other places. In particular, the Chalkis-loom weights were close to the early conical loom weights from Corinth of “profile I”.³

They were nevertheless almost certainly produced locally in Chalkis, since they were made of the same kitchen, coarse and fine wares as much of the pottery. And the majority of the pottery was probably Corinthianising rather than being Corinthian imports. Also, and more importantly, the Chalkis loom weights were smaller and lighter than the loom weights published from Corinth and the Corinthia. Even the two small-looking conical loom weights of “profile I”, recently published from the Panayia field at Corinth, were almost three times as heavy (120 g and 150 g respectively) as most of the small loom weights from Chalkis.⁴

Table 5.1. Loom weights, loom weight-spools and spools from Archaic contexts

Type	35–45 g	50–65 g	66–95 g	96–120 g	Total
Lw	13	20	32	33	98
Lws		15	4	1	20
Spool				13	13
Total	13	35	36	47	131

The table shows the frequency of weight classes of the loom weights (lw), loom weight-spools (lws) and spools.

Obviously, these small implements were used for a very fine textile production and such a production is known from actual pieces of textile.

Fragments of exceptionally fine textile, dating to the same period as the majority of the Chalkis loom weights (7th century BC) were found in tombs in the Corinthian colony in Corfu – a day or so by sailing boat to the northwest of Chalkis. Here thread count could reach as much as 120 threads/cm and the diameter of some threads was less than 0.1 mm.⁵

The many small loom weights in Chalkis appeared mostly close to walls, more rarely at a distance from the walls. Loom weight-spools, on the other hand, tended to be found in the centre of rooms, and spools almost always in the centre of the rooms. The three categories of implements must therefore have served different purposes. The loom weights were often found isolated, or together with one or two others. These small “caches” represented remains of “activities” near walls in which the small loom weights were used, but mostly it was difficult to estimate if the “cache” was intact or not, and, accordingly, to estimate if the “original” context had many more loom weights. However, in 14 cases, small caches of loom weights/loom-weight-spools appeared to have been preserved intact or near intact. The largest cache among these consisted of 14 loom weights/loom weight-spools and was excavated in the foundation strata of the house at the harbour. The remaining caches consisted of 4–7 loom weights and these were found in loom rooms in other parts of the hill. A closer study of these intact caches indicated that the cache with 14 loom weights in the house at the harbour was likely to stem from a procedure by which a narrow band was woven on to a finished piece of textile. The cache dated to the Middle Proto-Corinthian period and recalled a Cypriote plate, not much older, with a depiction of a loom with the same number of implements (in this case spools and loom weights), only here a wider piece of textile is being added to a finished border, and not vice versa.⁶

The smaller, “intact” caches of loom weights were also interpreted as stemming from border-weaving, possibly by means of a kind of tablet-weave where the warp were fastened to the wall. Again, there is iconographical evidence from the same period to support this idea.⁷

In certain cases, small caches of loom weight-activities were found at opposite walls in the same room, forming “pairs” (Table 5.2). Moreover, all the identified loom rooms on the hill of Agia Triada were estimated to have been of more or less the same size (roughly 9 m²) and to be located in the north and open towards a courtyard in the south as an early kind of *pastas*-house. This homogeneity of the loom rooms and the spatial arrangement of activities relating to textile manufacture further strengthened the impression of a specialized textile production where rooms were especially constructed to house the work of the weavers. The size of the best preserved loom rooms and the location of the caches at opposing walls suggested that two teams of weavers worked at the same time on two different borders which were possibly meant to frame the same (already) finished piece of textile. Paintings on Archaic pottery from Greece and Iron Age imagery from rich tombs in central

Italy sometimes show “pairs” of women working on borders.⁸

The loom weights and spools could be ascribed to “activities” which related to walls. Of these, 26 activities with loom weights/loom weight-spools took place near walls and 12 activities took place in the center of rooms and primarily involved the use of spools, loom weight-spools and more rarely loom weights.

One more aspect further confirmed the impression of a specialized textile manufacture. In 16 cases, a “weaving kit” was tentatively identified near the activities with loom weights/spools. The weaving kits could largely be divided in two categories:

(A) small ceramic containers (pyxides and/or cups used as pyxides: ray-kotylai, Thapsos-class skyphoi, large skyphoi, *exaleiptra* used as containers), micro-blades of flint, a possible smoothing stone.

(B) small, flat-bottomed and tall necked jugs. Sometimes also pyxides, and miniature vessels.

Weaving kits of the first kind (A) are known from Iron Age tombs in Greece and Italy, but have so far not been identified in settlements of the same period. The small, flat-bottomed and tall-necked jugs characteristic of the second category (B) of kits were ideal in a work environment as the broad bottom made it easy to place the bottle on uneven floors or work-tables and the tall neck helped to control the pouring of small amounts of precious liquid. In two cases, such bottles with dog-tooth-pattern and dating to the Middle Proto-Corinthian period, were found standing next to an “intact” cache of loom weights (caches act/w-14 and act/w-15 in loom room N-1). Conical, tall-necked jugs of the Middle Corinthian period were found in association with loom weights in loom rooms LR-2b and LR-9. Perhaps, the tall-necked jugs contained a liquid for anointing the fine threads to prevent them from drying out and avoid a fatal breakage. Fragments of such bottles were also found together with loom weights, possible spindles and a possible spindle-hook in the surface-pavement of the Archaic road running along the row of loom rooms N-1, N-2, and N-3. (see [Fig. 5.1](#)). These finds may show that the jugs were carried in procession, perhaps together with pieces of textiles, and/or together with implements for the manufacture of textiles. The depiction of a religious procession on a plaque found in the Pitsa cave dedicated to the Nymphs near Sikyon and Corinth shows women carrying baskets on their head (*canephoroi*) in which stand the same kind of tall-necked and conical jugs. The plaque dates to around the time of the mentioned pavement of the Archaic road in Chalkis (540/30 BC). Finally, small loom weights were also found in two loom rooms inside the acropolis wall (LR-5, LR-7) and in a “sacred pit” thrown up against the acropolis wall (LR-1). One of these loom rooms (LR-7) lies very close to the presumed entrance to the acropolis, near the Early Christian Basilica in the area in which the ancient shrine is likely to have stood. Several small loom weights from this

loom room carried stamped decoration, one of which was an exceptionally small loom weight with a complex imagery referring to the Palladion and the Athna Ergane in Troy.⁹

Table 5.2. Examples of the “intact” caches of loom weights/loom weight-spools.

<i>“Intact” activities with loom weights</i>	<i>Total lw and lws</i>	<i>Loom room</i>	<i>Wall</i>
House at the harbor			
Act/w-4	14	6a	N
Loom rooms at the road			
Act/w-14	6–7	N-1	SE
Act/w-15	(1)*	N-1	NW
Act/w-16	5	N-2	SE
Act/w-17	5	N-2	NW
The Acropolis			
Act/w-28	6	LR-7	E
Act/w-29	5		S?

Table 5.3 A list of the houses and rooms with Pinna fragments and micro-blades.

<i>Pinna & micro- blades/houses & loom rooms</i>	<i>Pinna</i>	<i>Micro- blade</i>	<i>No. loom weight activities at walls</i>	<i>No. activities in centre with lw/lws/spools</i>
House at the harbor	5	12	9	5
Archaic road w. loom weights	3	2	3+	2
Acropolis NW & summit	1	5+	4	
Shrine w. altar	1	1	1	
Acropolis SE	1	1	(1)	

The presence of implements for textile production in the same contexts as the Pinna and the micro-blades is summarised in the unshaded columns.

Basins on high stands (*louteria*) and large basins for grinding (*mortaria*)

constituted a special feature in Chalkis. In total (including finds from the survey), 21 fragments from different *louteria* and *mortaria* were found. Four, possibly as many as six, fragments, date to the early 7th century BC and come from foundation strata. Ten fragments stem from the end of the 7th/beginning of the 6th century BC and four date to the early 5th century BC. The basins were Corinthian or Corinthianising and had close parallels in Corinth, and Perachora, but also to those published from the Greek-style sanctuary at Timpone della Motta outside Sybaris in south Italy.¹⁰ The latter sanctuary has been shown to be devoted to a cult for Athena Ergane in her capacity as a spinning and weaving goddess and to be rooted in a local Iron Age sanctuary with a similar function. The distribution of the *louteria* and *mortaria* was concentrated to loom rooms and the sacred pit in the vicinity of the presumed entrances to the acropolis and to the three loom rooms in the large house at the harbour. They may therefore have played a role in textile manufacture. The Trojan Athena Ergane, likewise worshipped as protector of spinning and weaving, held a special position in Corinthian vase painting.

In summary, the architectural and movable evidence for a specialized textile production from the promontory of Agia Triada was striking, in particular in view of the relatively short period of excavation with a limited number of people. Finds of *Hexaplex* and *Pinna* were intimately tied to this specialized textile production.

The finds of *Hexaplex trunculus* and *Pinna nobilis*

The earliest preserved fragment of sea silk is constituted by an example from the 4th century AD site on the Taborberg, near Aquincum-Budapest.¹¹ This meagre evidence for sea silk in archaeological excavations should nevertheless be contrasted with the fact that the *Pinna* was well known to people in the Aegean in ancient times.

In recent years, many shells have been published thanks to a laborious investigation of molluscs from older and newer excavations in Greece. According to this important survey, almost all published *Pinna* fragments stemmed from prehistoric strata.¹² Among these, only sporadic finds came from Early and Middle Bronze Age contexts. By far the majority of the *Pinna* fragments were found at Bronze Age sites such as Asine, Mycenae, Midea, Lefkandi in mainland Greece and Mochlos and Khania in Crete. The purpose for which the shell was used was mostly not known, but the fact that the shell was far less frequent than other molluscs indicated a use beyond purely dietary purposes. In a few cases, the *Pinna* was found in “special” rooms, such as the “temple” (room 18) and the “store room with the idols” (room 19) in Mycenae, and sometimes the edges of the *Pinna* fragments had been worked (Mycenae, Midea), and its shell had been used as inlay or mosaic.

In contrast to the relative frequency of *Pinna* in Bronze Age excavations, the

shell has only been identified at two Iron Age sites. These were fragments from Proto-Geometric tombs and pits in Lefkandi, and a few shells from Late Geometric strata in Asine-Kapsorakhis, in total of around 55 fragments.¹³

Till now, *Pinna* shells have not been published from the Archaic and Classical period, while they seemed to be more regular finds in Roman-Byzantine excavations, and here again some shells had been worked and used as inlay.

Against this background, the finds of 24 *Pinna* fragments from Chalkis proved an important addition to prevailing evidence for the use of this mollusc in ancient Greece. The fragments were also of particular interest, since almost all of the fragments (20) came from Archaic strata and not from Prehistoric or Hellenistic-Byzantine contexts. In other words, their find circumstances were the reverse of those in other Greek excavations where *Pinna* exclusively were found in Prehistoric strata and occasionally in Early Iron Age contexts. This situation clearly suggested that a new and different kind of interest in the shell (the largest bivalve in the Mediterranean Sea) developed in 7th century BC Chalkis, and this circumstance ties in well with the experimental and innovative character of the textile production described above.

Around 22 different mollusc species were identified in the Archaic strata amounting to a total of 430 marine shell fragments. *Cerastoderma glaucum* and *Cerithium vulgatum* were by far the most frequent ones. The *Hexaplex* was the third most frequent mollusc and the *Pinna* the fourth most frequent one, even if they only amounted to 48 and 22 fragments respectively.¹⁴ Some of these fragments may come from the same individual making the number even smaller. Nevertheless, one should not dismiss the possibility that the fragments stem from dye extraction and byssus exploitation on the grounds of the small number of fragments and individuals. All moveable remains from the Archaic settlement were extremely fragmentary. Floors were only preserved in small patches, and with rare exceptions, only tiny fragments of pottery vases had survived. Just as the total number of shells (430) and animal bones (1022, see below) in no way mirrored the total consumption of marine and animal resources in Archaic Chalkis, the surviving pottery fragments, weaving tools and other artefacts in no way represented the total inventories of the settlement! In spite of the extensive excavations on the hill of Agia Triada, the Archaic settlement was extremely difficult to follow, and it is still one of the great archaeological puzzles why, on the whole, so few settlement remains have survived in mainland Greece from the 7th century BC, Corinth and Athens being the prime examples. In other words, the study of daily life in Early Archaic mainland Greece on the basis of finds from settlements is still very much dependent on bits and scraps. In the following discussion, the *Hexaplex* and *Pinna* fragments are therefore discussed with these general limitations in mind. A comparison between the occurrence of *Hexaplex/Pinna* and – supposed – offal from food preparation/meals, such as cockles and bones from

domesticated animals, suggests that the consumption of *Hexaplex/Pinna* in food production was *secondary* to a function related to textile manufacture.

Apart from the marine shells, 1022 animal bones were found in the Archaic strata. The majority came from domesticated animals such as cattle, goat/sheep and pigs (463 bones were undeterminable). Both the cockles and the animal species are well known components in the ancient Mediterranean kitchen. In general, cockles and animal bones were present in the same strata as *Hexaplex/Pinna*. The only major difference was the presence of a (relatively seen) large amount of cockles and a (relatively seen) large number of animal bones in the fill of the Archaic road while only a few fragments of *Hexaplex/Pinna* were found here. Also, the fill of the Archaic road was heavily mixed with prehistoric material and was accordingly an uncertain source for the Archaic period. On the whole, the general co-presence of *Hexaplex/Pinna* and cockles/domestic animal bones in stratified Archaic contexts suggested that the “processing” of the *Hexaplex/Pinna* shellfish followed the same “process” as cockles/domestic animal bones. *Hexaplex/Pinna* may therefore have formed part of a diet but the shellfish may still have served a dual purpose and been used both for eating and for textile manufacture. In the latter case, it was of course most practical to prepare the shellfish for both purposes at the same time. The inedible “threads” (byssus) of the *Pinna* had to be cut loose from the shellfish, cleaned and combed and the likewise inedible hypobranchial gland of the *Hexaplex* needed to be picked out, crushed and blended, while the edible meat of the shellfish needed to be processed differently.

A study of the contexts of *Hexaplex/Pinna* over time suggested that the two shellfish species did indeed primarily serve a purpose in relation to textile production. *Hexaplex* was well represented in the prehistoric strata, both on the promontory of Agia Triada and at the prehistoric site on Pangali on the other side of the small bay of Chalkis (in total 52 fragments). One of the examples from the latter site showed clear signs (a chipped-off hole on its last whorl) that the hypobranchial gland had been extracted.¹⁵ In other words, the consumption of *Hexaplex* had a long history in Chalkis and the knowledge of dye extraction from this shell may date back to prehistory. In the Archaic period, the use of the *Hexaplex* was resumed already at the time of the foundation of the Archaic settlement, but fragments of the shell were now exclusively found in rooms near the harbour and at the main entrance to the acropolis above the harbour. As mentioned above, *louteria* and *mortaria* followed a similar pattern. In fact, *Hexaplex* fragments were sometimes found in the same pits as fragments of *louteria* and *mortaria*. Various later Greek sources show that high-stemmed basins were used for washing and possibly for dyeing of fibre.

In contrast to the century-old tradition in Chalkis to consume *Hexaplex*, experiments to make use of the *Pinna* were far more frequent in the Archaic period than in the Bronze Age. Interestingly, *Pinna* fragments were not present in the foundation strata, but appeared suddenly in contexts dating to the early

6th century BC (Middle Corinthian period), and they appeared at the same time and in the same contexts as the micro-blades, spools and special containers for ointment (*kothons*) (Table 5.3). Therefore, the micro-blades may – very tentatively – be interpreted as having served to cut the byssus from the *Pinna* shell, and the *kothons* as having contained some kind of oily moisture to enhance the golden colour of the byssus, and the spools as implements for storing the precious thread.

Table 5.4. The excavated rooms in Archaic Chalkis: the evidence for textile manufacture in relation to the presence of micro-blades, *louteria*, *Pinna nobilis*, *Hexaplex trunculus* and animal bones.

Room	Activities with lw, lws & spools. No. activities no. implements	No. weaving kits	Micro-blades (m-b) and other implements related to textile manufacture	Louteria	<i>Pinna nobilis</i>	<i>Hexaplex trunculus</i>	Animal bones
House at the harbor							
<i>Prehistoric strata</i>							
Area of Rms 1–6					4	17	(many)
<i>All Archaic phases</i>							
Rm 1		1	2 (m-b)		1		
Rm 2							
Rm 3	1 (2)					2	
Loom room Rm 4 with drain	7 (10–11)	3	8 (5 m-b)	6	7	14	18
Rm 5 (storage/passage)	1–2 (3)	1	1 (m-b)		1		13
Loom room Rm 6a–b	6 (27)	2	6 (2 m-b)	1	2	2	
Loom room Rm 7a–b	4 (12–17)	2		1–2	2	1–2	46
Rm 8 (narrow road)							
Loom room? Rm 10	2 (6)	1					
Loom room? Rm 11	1 (2)						
Archaic road							
Rd 1–2							27
Rd 3	(11)		1		1	3	15
Loom rooms at the road							
N-1	3 (8)	2	1				27
N-2 with drain	3 (13–14)		1		2		14
N-3	1 (2)						3
LR-8	1–2 (8)		1 (m-b)				
Other loom rooms							
LR-6	2 (3)	1					?
LR-5	2 (7)			1			?
LR-2b	1 (3)	1	2 (m-b)	5	1	4	?
LR-3	1 (2)	1+					?
LR-7	2 (6)			3			?
Tx41-Tx43	1 (2)		1 (m-b)		1		?
LR-10	1 (?)						?
LR-9 (altar)	1 (?)	2					?
LR-11	1 (5)	1	1 (m-b)		1		
Sacred pits							
LR-1	41-W	1	?1 (m-b?)	1	1		
?	?					?2	
Total					24	36 (?40)	

It should be noted that except for Rooms 4, 6a–b, and 7a–b in the “House at the Harbour”, the rooms were either not completely excavated or poorly preserved.

Table 5.4 summarises the find-contexts of *Hexaplex*/*Pinna* in relation to the

evidence for manufacture of fine textile in the excavated rooms throughout the Archaic phases.¹⁶ As seen, *Hexaplex/Pinna* fragments were only found in rooms which also contained implements for manufacture of very fine textile (and often in the same strata as these), and the more numerous the shellfish fragments, the more numerous the loom weights, spools, and *louteria* (in some rooms). This apparent co-presence of *Hexaplex/Pinna* in contexts with evidence for textile manufacture is the more striking, since both shellfish disappear after the Archaic period. While cockles/animal bones continued to be present in the strata of the Classical-Hellenistic houses, *Hexaplex/Pinna* did not.

In summary, the use of *Hexaplex* appeared at the same time as the small, homogeneous-looking loom weights (conical and pyramidal), loom weight-spools (conical) and *louteria* and *mortaria*, and *Pinna* appeared when small pyramidal loom weights had become standard and at the same time as spools and micro-blades. Both *Hexaplex* and *Pinna* disappeared when these implements disappeared. Loom weights from the Classical-Hellenistic houses were generally much larger, heavier and non homogenous, and loom weight-spools and spools were no longer used.

On the basis of this development, the primary use of *Hexaplex/Pinna* could be related to textile production in the Archaic period.

Conclusions: a specialized production of textiles with patterns in sea silk and purple colours

Huge amounts of the shellfish *Hexaplex/Pinna* would of course have been needed to produce colour dyes and sea silk respectively, for a specialized and commercial textile production. No dyes from such a production have been found in Chalkis. Obviously, the stinking and rotting remains from the processing of shellfish and animal products (crushing, slaughtering, flaying, tanning, dyeing etc.) were disposed of at a distance from the houses and, in the case of Chalkis, well away from the fragile and refined textile manufacture. Since excavations were only conducted inside inhabited areas, the lack of middens is not surprising. The excavated rooms gave the impression of having been well-organised work units in which floors were swept regularly. Less demanding stages in the manufacturing industry and food production, such as rinsing and cleansing of the byssus, small-scale dyeing and cooking for daily consumption would have taken place here, alongside small scale industry of work implements (iron, wooden and stone tools) and of course the weaving of fine textiles. Fragments of pottery, animal bones and molluscs must be regarded as *overseen* waste material from such processes *after* floors had been swept. In the few cases, where more complete pots and caches of loom weights/spools or other implements were made, these finds had been left behind already in antiquity for unknown reasons.

The character of the loom weights and their find circumstances suggests a

specialized manufacture of fine textiles, probably bands and borders, which flourished in the 7th and 6th century BC. Many different sources – too many to be summarised here – show the importance of finely patterned bands and borders in the Archaic period. In general, the 7th century BC was a period in which luxury objects from the East reached a growing class of *nouveau riches* in Greece and Italy, including purple-dyed garments with details added in gold threads.¹⁷ Funerary garments, finely patterned and covered with decorations in gold-leaf have appeared in many rich tombs in Greece and Italy, and in some cases also thin bands made of gold-leaf with hammered patterns, imitating woven bands.¹⁸ This new taste for luxury also stimulated the production and trade of a whole new range of imitations of luxury items. One such market would have been imitations of gold threads and of the precious purple colour, extracted from murex shellfish. Chalkis, at the entrance/exit to the Corinthian gulf, was ideally located for the establishment of such a market. Knowledge of how to use *Hexaplex* for purple dye apparently had a particularly long history at Chalkis, and rich fields of *Pinna* lived in the Corinthian Gulf in places such as Perachora and the bay of Chalkis. Perhaps therefore, we may imagine a textile production in Chalkis which was specialized in patterns made with threads of byssus in imitation of gold threads, and threads dyed purple by *Hexaplex*. As was so well demonstrated during the conference in Lecce, the preparation of sea silk demands very little space, and experiences of success and failure can be developed and kept on a family basis, much like cooking recipes. The main ingredients are water, smaller basins, small sharp knives, combs and not least a good deal of patience for the various washing and cleansing procedures. The tiny and extremely sharp micro-blades, which were excavated in several loom rooms in Chalkis would have worked perfectly to loosen the byssus from its shell and cleanse the byssus from dirt and unwelcome particles. The water channels and *louteria*, excavated in several loom rooms, may have served both to wash the byssus but also as containers for small amounts of dyes for special threads.

The golden age of the Chalkis-textiles was the 7th and 6th centuries BC period when Corinth played an active role in utilising and formalising trading networks in the Adriatic sea and the waters around South Italy and Sicily. By Hellenistic times, cities like Taranto in south Italy had completely taken over the production of both sea- silk and dyes with *Hexaplex*, and the textile production at Chalkis had accordingly changed and no longer made use of sea silk and shellfish purple dyes.

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1 This article would not have been possible without the labourious and skilled study of the molluscs from Chalkis by geologist Kaj Strand who generously shared his knowledge with me. Kaj died too early, but his great humour and cheerful good nature is for me imbedded in the hundreds of bags of shellfish material from Chalkis. I therefore dedicate this article to Kaj.

2 I am extremely grateful to Dr David S. Reese for his many wise comments and for providing me with his many off-prints on studies of shellfish purple dye.

*The weight of one of the loom weights in this category could not be estimated more accurately than 120/215 g.

3 Compare Davidson 1952, 149 fig. 123 and nos 1069, 1075.

4 Sanders *et al* . 2014, 46 nos 37–38.

5 Spantidaki and Moulherat 2014.

6 Rahmstorf 2005.

7 Houby-Nielsen in press.

8 Houby-Nielsen forthcoming.

9 Houby-Nielsen forthcoming.

10 Kleibrink *et al* . 2004; D'Andrea and Kindberg Jacobsen 2010.

11 Barber 1991; McKinley 1998, 28 referring to a letter by E. Barber from 1994, 52–53.

12 This survey is based on Burke 2012.

13 David S. Reese (unpublished) Lefkandi: from Late PG tombs (fill above floor of P tomb 3), from LPG/SubPG P tomb 7, SPG P Pit 1, LPG-SPG III P Pit B in the north boundary ditch of cemetery in 1970 produced 27 *P. nobilis* probably from ca 3 individuals; isolated examples (fragments) from the Xeropolis settlement from PG to G strata.

14 Strand 2006 and pers. comm., for the species.

15 Strand 2006, fig. 89.

16 Based on Houby-Nielsen forthcoming, with appendices by Kaj Strand and Pernille Bangsgaard. The shells and animal bones from the prehistoric strata were published by Strand 2006 and Bangsgaard 2006 respectively.

17 Compare for instance the textile production in the Neo-Assyrian Empire: Gaspa 2013.

18 For good summaries, see Gleba 2008; Stampolidis 2012.

Taras and sea silk

Francesco Meo

This volume is a good opportunity in which to take stock of the state of the research on the relationship between the ancient city of Taras (Fig. 6.1) and possible sea silk workshops in the *polis*. More specifically, this paper will focus on the possible historicity of the manufacture of this fibre in the Greek colony by cross-checking information from historical sources, records of the last centuries and archaeological data, collected to date for this town.

The relationship between Taranto and textile production clearly emerges from a long-term literary and epigraphic tradition which began in the Archaic period. The most ancient Greek inscription from the town, dated to 540–530 BC, is believed to refer to a prize for teasing wool.¹

Hesychius remembers the term *daîma* being used by Tarentine people to indicate warp; another specific term is *estalopia* which is a place for the trade of cloaks (*himátia*); finally *sphinktér*, the name Tarentine people used to indicate the *chiton*, can be interpreted as proof of the production of specific items of clothing.²

The existence of particular cloths is also confirmed by those sources that refer to the *Ταραντῖνον* (Hsch., s.v.; Phot., s.v.) or *Ταραντινίδιον* (Suid., s.v.) or *Ταραντεινόν* (Zonar., s.v.). This type of robe may date back to the end of the 5th century BC³ as Aristophanes (*Lys.* 16), Polyaeus (V, 3, 3),⁴ Menander (*Epit.* 272, 488–489) and a series of inscriptions (IG II, 2, 751; 753, 1.2; 754, 1.37; 755, 1.29; 756, 1.15; VII, 2421) attest to the presence of this item in the *polis*.⁵ The *Tarantinon* is a long, very light and delicate garment typical of Taras, particularly suitable for women, but which was also worn by men who wanted to flaunt their wealth (Eust., *Comm.Dion.Per.* 376; Luc., *Rh.Pr.* 15; *Ep.Socr.* 9; Ath., XIV, 622 B).⁶

A complex textile production system seems to emerge during the 3rd century BC, as attested to by some epigrams of Leonidas of Taras (*Anth.Pal.* VI, 286, 288; VII, 726).⁷ In the following century production has recently been ascertained along the northern coast of the Gulf of Taranto and, more particularly, in the Tarentine colony of Herakleia.⁸

Together with items of clothing typical of the *polis*, breeding for the production of the very refined Tarentine wool, well known for its quality, was of huge relevance. Jean-Paul Morel has extensively dealt with the wool production in Tarentum by dividing the analysed texts in literary and technical

depending on the type of information they provide (Hor., *Carm.* I, 31, 5–6; II, 6, 10–12; Calp., *Ecl.* II, 68–69; Stat., *Silv.* III, 3, 93; Mart., II, 43, 3–4; IV, 28, 1–3; V, 37, 1–2; VIII, 28, 1–6; XII, 63, 3–5; XIII, 125; XIV, 155; Tert., *De Pal.* 3, 6; Plaut., *Truc.* 649; Varro, *Rust.* II, 2, 18; Str., VI, 3, 9, C 284; Columella, *Rust.* VII, 2, 3–4; VII, 4, 1; Petron., 38.2; Plin., *HN* VII, 190; VIII, 191; XXIX, 33; Quint., *Inst.* VII, 8, 4).⁹

However, none of these sources seems to specifically allude to sea silk or *Pinna nobilis* (Fig. 6.2). Yet, the mollusc has been known since ancient times: Aristotle (*HA* V, 15: 4th century BC), in fact describes the fan shell *Pinna*, stating that it grows straight up from its tuft by anchoring fibres in sandy and slimy places.¹⁰ In addition to this passage in Aristotle, it is possible to assume that features of the ancient Taras coastal marine environment, as well as in the 1920s, were certainly appropriate to the growth and reproduction of the molluscs. Beniamino Mastrocinque states that between 20,000 to 30,000 shells were fished every year, basically for food.¹¹ Moreover, about a decade later, Rita Dal Bene patented a process for the manufacture of fabric with sea silk.¹² What Mastrocinque writes is most interesting since we know that the weight of the raw fibre per animal is about 1.5 g and, with a similar amount of shells, just 30–40 kg per year could be collected.¹³

If we hypothesise that intensive fishing had already begun in ancient Taras, two preliminary considerations can be made. First of all, such a large amount of faunal material must have left traces in the archaeological contexts of the *polis*. These data are certainly influenced by the randomness of the findings, the relatively low importance given to such finds by past archaeological research and the difficulties of working in a city such as Taranto, which has been continuously inhabited since antiquity. It is in fact possible that the area where *Pinna* shells were trashed has not been found or that possible fragments of these molluscs have not been recognised during the excavations. Moreover, it is not possible to exclude the possibility that the climate conditions of some contexts were not good enough for their preservation.

On the other hand, the limited amount of available fibres would make the cloth highly precious, with a resulting small number of annually produced fabrics. This does not clash with what historical sources write about the *tarantinon* namely, a precious, fine and light cloth, certainly not for common use.

Both these problems therefore require wider reflection. As to the faunal material, no sites with a large amount of remains of *Pinna nobilis* have been identified, to date. This lack is significant when compared to the remarkable remains of snails used for the extraction of shellfish purple dye. The so-called *Monte dei Coccioli*¹⁴ (murex-shell hill) has, in fact, for centuries characterised the coastal landscape of the *Mar Piccolo* (the inner sea of Taranto; Fig. 6.3). In the second half of the 18th century, the local guide of Baron Von Riesel

showed him a murex hill formed from scraps of shellfish purple dye extraction in antiquity.¹⁵ At the end of the following century the British writer Janet Ross records that, not far from Saint Lucia, on the shores of Mar Piccolo, there was a huge amount of murex shells.¹⁶ The antiquity of this shell hill finds a match not only in the historical sources, with the indication of real shades of shellfish purple dye colour, the *rubra Tarentina* (Plin., *HN* 9, 137), but has been recently confirmed by the discovery, in the harbour area, next to Saint Lucia (Fig. 6.4), of a series of terraces created by the alignment of transport amphorae, dated to the 3rd–2nd century BC. The murex shells were chopped up filling both the amphorae and the terraces, which were used for the drainage of rainwater.¹⁷

The notable traces that the intensive fishing of murex snails have left in some contexts of the ancient *polis* is not matched by an equally consistent documentation regarding *Pinna nobilis* shells. This data is very significant, with an annual fishing quota of tens of thousands molluscs in mind, such as described by Mastrocinque at the beginning of the 20th century.

The apparent lack or failed identification of *Pinna* shellfish remains does not necessarily imply that sea silk fibre was not used. It is in fact possible that the fishing of *Pinna nobilis* was much less intense than what was written at the beginning of the last century. Moreover as noted, Mastrocinque still writes about the predominant food use of the mollusc. Even admitting this proposal as probable, the amount of available raw sea silk fibre would have been extremely low and probably not enough to produce entire cloths.

Nevertheless, the suggestion that the *tarantinon*, a very delicate and almost transparent robe, was realised with sea silk has been, and is still, very strong. In some cases, indeed, such a suggestion is so compelling that the description of the fineness and lightness of *tarantina* has traditionally been seen as evidence that they were made of sea silk fibres.¹⁸ Of course, the present state of knowledge does not make it possible to affirm the opposite. However, doubts about the link between *tarantinon* and the raw material used for its weaving have been expressed on several occasions and from different points of view.

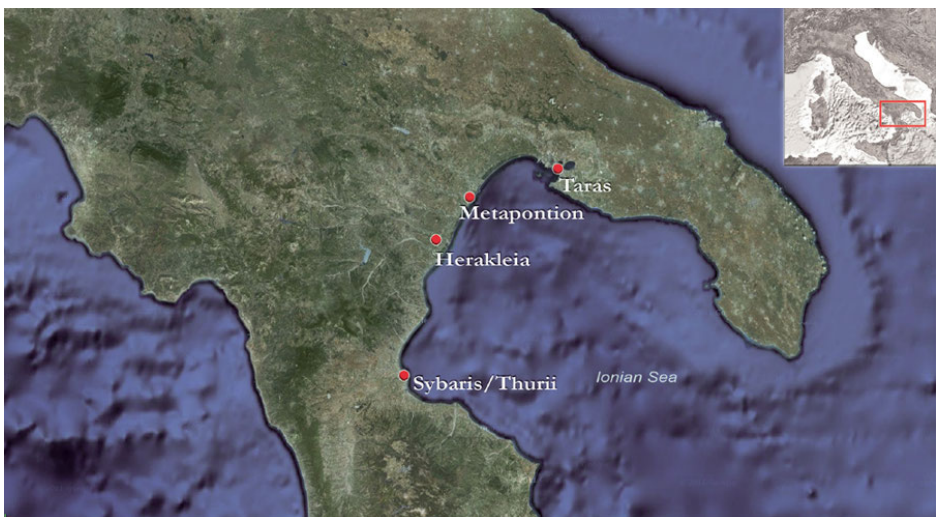


Fig. 6.1. Taras and the other main Greek poleis of the northern coast of the Gulf of Taranto (F. Meo).

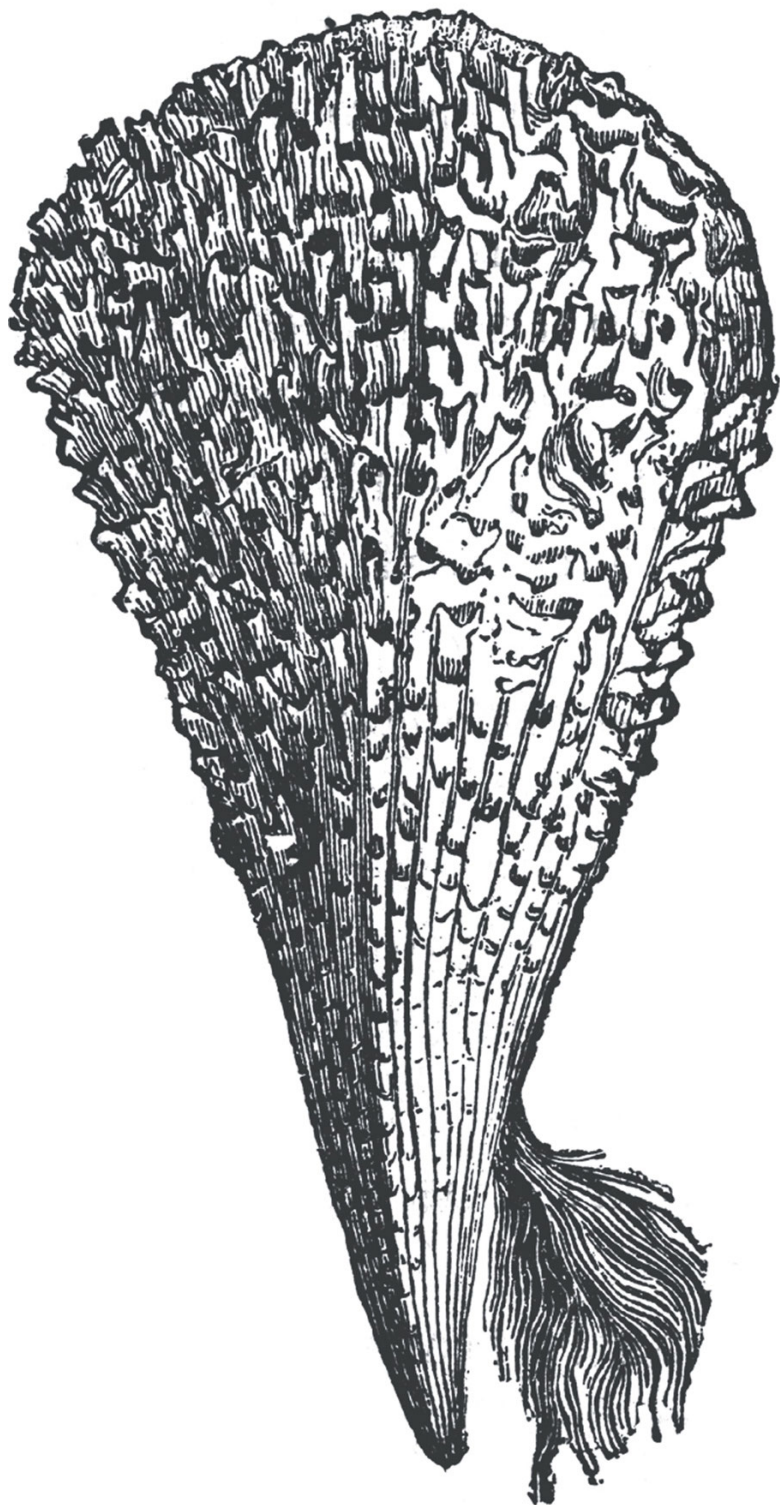


Fig. 6.2. Ancient drawing of the Pinna nobilis (Cuppy 1895).

First of all, no source ever makes any clear connection between the *tarantinon* and a specific fibre. Pierre Wuilleumier writes that, despite the doubts of Lorentz Rudolphus and Arthur J. Evans,¹⁹ “cette mouselline était certainement tirée de la laine, et non d’un coquillage imaginaire.”²⁰ Enzo Lippolis also points out that the term *tarantinidion* indicates a type of easily distinguishable dress that does not seem related to the use of a particular fibre.²¹



Fig. 6.3. The position of Taras between the Mar Piccolo (inner sea) and the Mar Grande (external see) (F. Meo).

A further doubt is due to the amount of sea silk necessary to weave a dress, which alone would have required thousands of *pinnae*. Some sources in the last centuries, indeed, link sea silk to the production of small cloths: Giuseppe Capecelatro, archbishop of Taranto in the 18th century, mentions socks and gloves;²² Janet Ross, in the following century, writes of ties and gloves offered as souvenirs to foreigners.²³

As regards the shine of the fabric it should be emphasised that the marine byssus is initially brown (Fig. 6.5). J. Ross writes that it has a dark yellowish-brown colour.²⁴ G. Capecelatro writes that garments of *lanapenna* (sea silk) are not transparent.²⁵ B. Mastrocinque notes that Ludovico De Vincentiis describes the natural colour of the fibre as similar to iron flakes.²⁶ It becomes shiny after being plunged in an acidified liquid such as lemon juice.²⁷ Since the lucent colour is obtained from the immersion in an acid substance, the problem of the identification of what substance could lighten sea silk worked in the Archaic period at Taras, is definitely opened, as it is hard to imagine the presence of lemons in the *polis* at that time. Analysis of the pollen records from a 9th–7th century BC context from Kyme (Cuma) has identified some grains of the *Citrus* species, but the most ancient archaeological samples of lemon (*Citrus limon*) in Italy come from the *Forum Romanum* and most probably date to the Augustan

period, while samples of citron (*Citrus medica*) have been discovered mineralised in the Pompeian temple of Venus, dated to the 3rd–2nd century BC.²⁸ Lemon traces are very rare because it is not a tree native to Italy: Theophrastus (4th–beginning of the 3rd century BC) reports in his *Historia Plantarum* (I 11, 4; 13, 4; IV 4, 2–3) that it is a tree originally from Media and Persia. While not excluding the possible presence of some lemons in the Taras harbour having arrived from the East, it is difficult to imagine the fruit to be present in the quantities needed to lighten sea silk. Mastrocinque, in fact, writes that 10 kg of lemons were necessary to lighten 1 kg of sea silk fibres.²⁹

The brightness of *tarantina* could instead derive from the inclusion of golden threads or leaves in the fabric, a material much more precious than sea silk and also archaeologically attested to, found in some burials at Taranto and Canosa dated between the 4th and the 1st centuries BC.³⁰

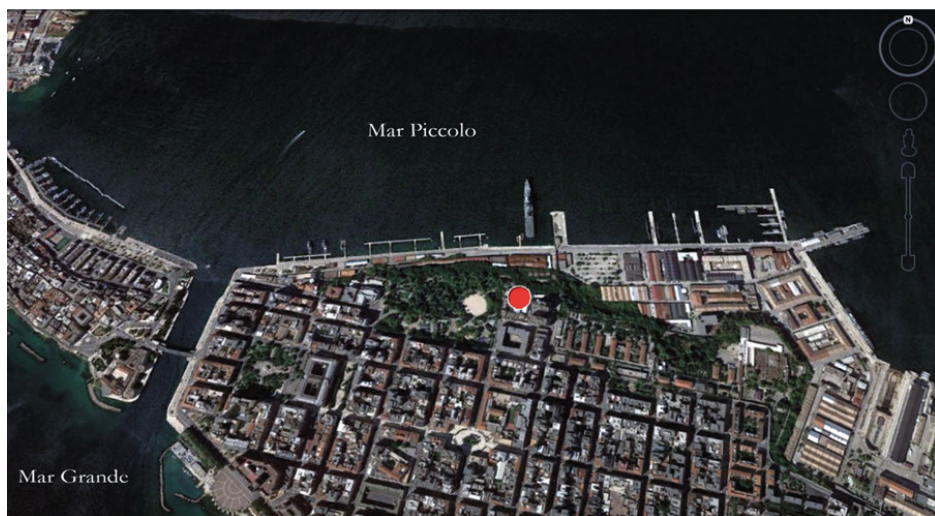


Fig. 6.4. Taranto, harbour area, ex Saint Anthony convent. Place of discovery of the terraces made with amphorae and murex shells (F. Meo).

However, the problem of the identification of the fibre used to weave the *tarantinidion* still remains. According to Judith Linn Sebesta, to cite an example, wool from Tarentum “was so fine that it could be spun into diaphanous material, and Tarentine rams were used in breeding programs around the growing empire.”³¹

Given the lack of clear evidence linking sea silk with the ancient *polis* of Taras, it is necessary to increase the geographical and chronological horizon in order to put the processing of this animal fibre in a historical context.

The *De Pallio* (3, 6) is the oldest universally recognised source on the use of this material for weaving.³² It is particularly important since the same passage refers both to Tarantine wools and to sea silk. Tertullian in fact writes, following a quick list of the most famous wools of the Roman Empire, among which the one of *Tarentum* is, “*Nec de ouibus dico Milesiis et Selgicis et Altinis, aut*

quis Tarentum uel Baetica cluet natura colorante ...”, of a fibre defined as vegetal “... *sed quoniam et arbusta uestiunt ...*” which is fished. He writes that flocks of a soft fluff obtained from the mane of some shells covered with moss, with seaweed, are from the sea “*Nec fuit satis tunicam pangere et serere, ni etiam piscari uestitum contigisset; nam et de mari uellera, qua muscosae lanositatis lautiores conchae comant.*”

Tertullian, from Carthage (second half of the 2nd and the beginning of the 3rd centuries AD), refers to *Tarentum* exclusively for its wool. He mentions the manufacturing of linen, sea silk and silk in general. It seems he takes weaving with these three “vegetal materials” for granted at least during his lifetime and he has been present at their production because he partially describes the various steps. However, he never identifies the Greek *polis* as a place of manufacture of sea silk as certain.

There exists no earlier ancient archaeological testimony as a counterpart to this passage. The oldest piece of cloth realised with sea silk fibres was discovered at the beginning of the 20th century in a 4th century AD context at Aquincum, today’s Budapest.³³ Aquincum was founded by Roman legionaries in the 1st century AD, became the capital of the Pannonia Inferior province and was at the *limes* of the Roman Empire.³⁴



Fig. 6.5. Steps of sea silk cleaning (Mastrocinque 1928, pls. i–iv).

This archaeological find was unfortunately destroyed during the bombings of World War II and so it is no longer possible to perform an in-depth analysis with modern and updated technologies. While not questioning the identification of the nature of the fibre, it would be interesting to understand how the fabric arrived in a city so far from the sea, on the north-eastern border of the Roman Empire. A huge amount of information can be provided by funerary epigraphs of the soldiers serving in the *legio* settled in the town (*Legio II Adiutrix*) in the 3rd–4th century AD.³⁵ An analysis of their origins (Fig. 6.6) clarifies that none of them came from the south of Italy. Some soldiers came instead from Numidia, the coasts of which are located not far from Carthage, the city of Tertullian.

Therefore, on the one hand we cannot perceive, once again, any link with Taras. On the other hand, if we consider again the passage of the Latin writer and his place of origin, it is possible to propose that in the Imperial period sea silk was used for the production of cloth along the North African coast.

This does not exclude that sea silk was woven also in other areas of the

Mediterranean, probably at Taranto, as well. But, since there is no confirmation (literary, epigraphic, archaeological) at this time about its manufacture in the Greek *polis*, it is only possible to hypothesise that a production on a small scale took place, as has also been proposed by the finds at the 7th century BC in a settlement on the hill of Aghia Triada in Chalkis.³⁶ The fibre was probably used for the realisation of small objects or for decorations on fabric, maybe woven with a high quality wool. Therefore, rather than thinking about a relationship with the *tarantinidia*, it is much more probable to connect the processing of sea silk to the needs of the poorest classes, to those fishermen who had fished the *pinnae* and eaten the mollusc, as has been suggested by Emanuele Greco on the basis of the suggestion offered by some epigrams of Leonidas of Taras.³⁷



Fig. 6.6. Origin of soldiers in Aquincum based on grave inscriptions (Zsidi 1995, 17; Maeder 2008, 115, fig. 6).

The present opinion, of course, is still waiting to be confirmed by some fortuitous archaeological discovery which can provide new data about one of the most striking textile fibres ever worked by mankind.

Acknowledgement

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1Mele 1997, 98. Although this inscription has been attributed to a symposium context (Nafissi 1998, 36; Lombardo and Frisone 2010, 289–290), a debate during the 55th International Congress on Magna Graecia entitled *Produzioni e committenze in Magna Grecia* (Taranto, 24–27 September 2015) confirmed its association with wool teasing.

2Mele 1997, 98–99.

3Mele 1997, 98–99.

4Hercher 1873, 67.

5Per le fonti più tarde vedi Grelle and Silvestrini 2013, 86–87 in English please.

6Morel 1978, 102–104; Mele 1997, 99.

7Mele 1997.

8Meo 2015.

9Morel 1976, 293–300; 1978.

10 He writes: Αἱ δὲ πινὰ ὀρδαὶ φύονται ἐκ τοῦ βύσσου ἐν τοῖς ἀμμώδεσι καὶ βορβώδεσιν . About the misunderstanding caused by the wrong translation of the term βύσσου created by Theodorus Gaza in the 15th century, who changed the word from masculine (which refers to *Pinna* shell) to feminine (which refers to sea silk) because of the lack of accents in the original text, see Maeder in this volume.

11 Mastrocinque 1928, 18.

12 Del Bene 1937.

13 Mastrocinque 1928, 18.

14 *Monte dei Coccioli* or *Monte Coccioli* is the name commonly used by Tarentine people: Viola 1881, 408. *Cocciolo* is the generic term to indicate murex, without any specific distinction of the species.

15 Von Riesel 1821, 141–142. The Baron arrives in Taranto on 20 May 1767.

16 Ross [1997], 82.

17 Dell’Aglia 2015, 441–445.

18 Mastrocinque 1928, 6–7; G. Capecelatro (1780, 14) already wrote that the ancient inhabitants of Taranto very likely used this fibre for some clothes. During the following century J. Ross ([1997], 81) writes that in ancient times a transparent and expensive fabric represented in several frescoes at Herculaneum was woven in this town. The tradition continues until today, spread by numerous websites and blogs by local historians and associations that want to promote the ancient history of Taranto (Mazzarino 2006; Bonivento Pupino 2010; Menarini and Scala 2013; Terenzi 2014).

19 Lorenz 1833, 12; Evans 1889, 66.

20 Wuilleumier 1939, 221.

21 Lippolis 1984, 331.

22 Capecelatro 1780, 14.

23 Ross [1997], 80–81.

24 Ross [1997], 81.

25 Capecelatro 1780, 14.

26 Mastrocinque 1928, 26.

27 Mastrocinque 1928, 26–28.

28 Pagnoux *et al.* 2013.

29 Mastrocinque 1928, 28.

30 Lippolis 1984, 339–340; Dell’Aglia 2005, 79–80.

31 Sebesta 1994, 67.

32 The term βύσσοϛ, *byssos*, comes from the Semitic (Hebrew *būṣ*, Assyrian *būṣu*). It is also attested in the Bible as *šeš*. Despite the attempt to link the term to sea-silk fibres (eg. Campi 2005), the important studies realised by F. Maeder

(see her article in this volume) demonstrate “how manifold the interpretation of the term *byssus* ” is, mostly translated as linen.

33 Maeder 2008.

34 Zsidi 1995, 81.

35 Zsidi 1995, 17; Maeder 2008, 115.

36 See Houby-Nielsen in this volume.

37 Greco 2005, 239.

Dal bisso grezzo al filato di bisso/From raw sea silk to byssus thread

Assuntina Pes and Giuseppina Pes

Sant'Antioco è una piccola isola che si trova nel sud ovest della Sardegna, terra ricca di storia e di tradizioni che si tramandano da generazioni. Una di esse, tramandata in forma scritta e orale, riguarda proprio la lavorazione del bisso marino.

Nel 1923–1924, nella scuola aperta dal maestro Italo Diana, venivano cardati, filati, tinti ed infine tessuti al telaio cotonei, lane e lini. Oltre a queste materie prime più «tradizionali», le allieve della scuola hanno avuto modo di imparare anche la lavorazione del bisso, materiale ottenuto dalla pesca della *Pinna nobilis* e comprato dal maestro al prezzo di un soldo a ciuffo.

Una di esse era Efisia Murroni la quale, frequentando la scuola dall'età di 15 anni, divenne ben presto un'esperta artigiana dell'arte della lavorazione del bisso, materiale che brilla al sole come oro e si sfuma cangiando in infinite tonalità che oggi trova tanto interesse da parte di molti studiosi per la sua rarità e particolarità. Dagli anni '90 e sino alla sua morte, avvenuta nel 2013, Efisia tramanda alle sorelle Assuntina e Giuseppina Pes – già esperte di tessitura tradizionale – tutti i segreti di questa antichissima arte.

La nostra esperienza di tessitura tradizionale inizia quando Assuntina, sorella maggiore, dopo aver frequentato corsi regionali svoltisi presso il centro pilota I.S.O.L.A a Sant'Antioco, si appassiona a questa antica arte e all'età di 18 anni costituisce insieme ad altre giovani una cooperativa di tessitura. Poco dopo anche Giuseppina, sorella minore, dopo aver appreso tutti gli insegnamenti e raggiunta la maggiore età, entra a far parte della cooperativa. La passione dimostrata da entrambe ci porta ad essere elette Vicepresidente e Presidente della cooperativa stessa, denominata Sant'Antioco Martire in onore del Santo patrono. La chiusura della cooperativa, la cui storia è lunga quasi 25 anni, non ha però fermato la voglia di portare avanti una così antica tradizione, cercando di tramandare con tanto orgoglio e sacrificio gli insegnamenti ricevuti.

La raccolta del bisso è oggi vietata, perché il mollusco che lo produce è in via di estinzione e pertanto protetto dall'Unione Europea dal 1992. Nel corso del workshop di Lecce il materiale a disposizione, donato dalla maestra Efisia alle sorelle Assuntina e Giuseppina, ha permesso la dimostrazione del procedimento di lavorazione del bisso: dalla pulitura, pettinatura e filatura,

sino alla messa in opera di tessitura su telaio sardo, del quale è stata inoltre presentata una miniatura con orditura e tessitura di bisso marino.

Il processo di lavorazione che ci è stato insegnato è molto simile a quello utilizzato e descritto negli anni trenta dalla tarantina Rita Dal Bene nel *Procedimento di fabbricazione di tessuti mediante la utilizzazione dei filamenti fibrosi della «Pinna Nobilis»*.

Il bisso grezzo si presenta sotto forma di una massa composta da filamenti misti ed ingarbugliati con alghe, conchiglie, pietruzze e tanta sabbia.

La prima pulitura richiede molta delicatezza e viene fatta in acqua di mare perché il movimento delle onde aiuta a districare più facilmente le fibre dalle impurità salvaguardandole dalla loro rottura.

Dopo questa operazione si passa a un secondo lavaggio che richiede molto tempo e pazienza, fatto in acqua dolce per eliminare la salinità dell'acqua marina; con questo lavoro vengono eliminate manualmente e con estrema delicatezza le impurità rimaste.

Si passa così al terzo passaggio: una volta che il ciuffo risulta abbastanza pulito, viene rilavato in acqua dolce e posto ad asciugare all'ombra tra due panni dopo averlo leggermente premuto con le dita per eliminare parte dell'acqua. Una volta asciutto il ciuffo si presenta secco e duro. Si procede quindi con un piccolo sfregamento per la separazione delle fibre e molto delicatamente vengono tolte le ultime impurità rimaste aiutandosi con un piccolo pettine che comincia ad allineare le fibre stesse.

Il momento successivo comprende la cardatura e la pettinatura. La cardatura è un procedimento abbastanza complicato da realizzare perché le fibre, molto fini e delicate, hanno bisogno di molta attenzione. Viene comunque eseguita con estrema delicatezza con un piccolo scardasso a denti d'acciaio finissimi, ripassando il ciuffo per due o tre volte cercando di tenere le fibre unite alla parte carnosa (se il ciuffo ha i filamenti troppo corti questo passaggio non viene eseguito). Quest'operazione renderà i filamenti più lisci e lucenti. Dopo di che con un pettinino a denti strettissimi si procede alla pettinatura con molta calma e delicatezza iniziando dall'estremità sino ad arrivare alla parte carnosa che verrà poi staccata. In seguito a questa operazione i filamenti sono pronti per la filatura con un piccolo fuso in legno duro.

Tutto il procedimento richiede 2/3 giorni di lavoro; molto dipende dalla grandezza del ciuffo e soprattutto dalla lunghezza dei suoi filamenti. Dopo la filatura il bisso marino è pronto per essere tessuto.

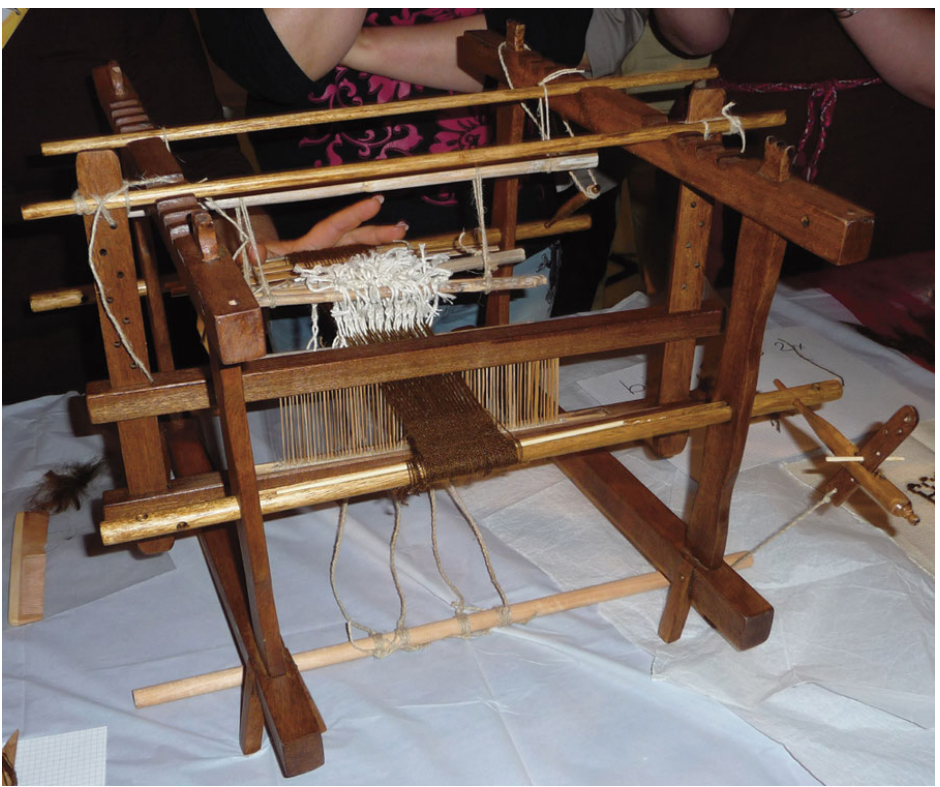


Fig. 7.1 Small loom with sea-silk weave.

Per ottenere il bel colore dorato il bisso già pulito deve essere messo per 24/36 ore nel succo di limone; una volta pronto, verrà nuovamente lavato, asciugato e pettinato seguendo gli stessi procedimenti sopra descritti. Al fine di perdere una quantità minore possibile di questo raro e prezioso materiale, noi preferiamo eseguire questa operazione dopo la filatura.

Saremo sempre grate al maestro Italo Diana per aver tramandato questo antichissimo procedimento che altrimenti sarebbe andato perduto, e agli insegnamenti ricevuti dalla nostra maestra Efisia Murroni.

Sant'Antioco is a small island located to the southwest of Sardinia, a place rich in history and cultural heritage where traditions from the elders are passed on to new generations. One of these traditions handed down, both orally and in written form, regards the working of byssus, sea silk.

In the years 1923–1924 in the school opened by the master (*maestro*) Italo Diana, cotton, wool and linen were carded, yarned, dyed and finally woven into magnificent textiles. In addition to these more traditional fabrics, the girls also learnt the working of sea silk, obtained from the byssus of the seashell *Pinna nobilis* and bought by the master for the price of a penny per tuft.

One of the young girls, Efisia Murroni, attending the school from the age of 15, became an expert craftswoman in the art of producing sea silk. Sea silk is a

material that shines like gold in the sun, fades and changes colours in countless shades. Today many scholars are interested in this fibre because of its rarity and the peculiarity of the fabric. From the 1990s until her death in 2013 Efisia passed on her knowledge and all the secrets of this most ancient craft to the sisters Assuntina and Giuseppina Pes, both already experts in traditional weaving.

Our experience in weaving began when the elder sister Assuntina after having attended regional courses held at the *Istituto Sardo Organizzazione Lavoro Artigiano* I.S.O.L.A. at Sant'Antioco became enthusiastic about this ancient craft and, at the age of 18, established together with other young people, a weaving cooperative. Shortly after, her sister Giuseppina, having reached the age of majority also joined the cooperative. Both passionate about the craft, they also accepted the positions of president and vice president of the cooperative, named *Sant'Antioco Martire* in honour of the patron saint. Having closed the cooperative after 25 years, today they try to pass on their knowledge of this ancient tradition with much pride and sacrifice.



Fig. 7.2 Weave with sea silk.

The gathering of the byssus tuft is now banned because the *Pinna nobilis* that produces it was put under the protection of the European Union (EU) Habitat Directive in 1992. For the workshop held in Lecce on 26/27/28 in May 2013, the sisters Giuseppina and Assuntina Pes used small samples of byssus given to them by their teacher Efisia permitting a demonstration of the ancient manufacturing process of sea silk, from cleaning, combing and spinning and weaving. They also showed a small Sardinian loom with a small piece of textile, warp and weft of sea-silk.

The process of making sea silk which we were taught, is very similar to that used by and described in the 1930s by the tarentine Rita Dal Bene in *Procedimento di fabbricazione di tessuti mediante la utilizzazione dei filamenti fibrosi della "Pinna Nobilis"*.

Raw byssus comes in the form of a mass composed of byssus filaments mixed and tangled with seaweed, little shells, pebbles and much sand. The first cleaning process requires a lot of awareness. It is done in sea water where the movement of the waves helps to more easily untangle the fibres of the byssus tuft from impurities and protects them from breaking.

After this operation, we switch to a second wash, also very long and patiently carried out in fresh water that will take away the salinity of sea water, while any remaining impurities are removed manually.

The next step involves carding and combing. Carding is quite difficult, because the very delicate and fine fibres need much attention. It is performed very gently with a small teasel with very fine teeth, striking the byssus tuft two, three times, while trying to hold the fibres together at the fleshy part. (If the filaments of the byssus tuft are too short this step is not performed). This will make the byssus tufts more smooth and shiny. Combing is done with a tight-toothed comb, calmly and gently, starting from the end of the fibres until you reach the fleshy part which will then be disconnected. After this operation, the filaments are ready for spinning with a small spindle in hardwood. The whole procedure takes 2 to 3 days of work, depending on the size of the byssus tuft and especially of the length of its filaments. Now the sea silk is ready to be woven.

In order to acquire the beautiful golden colour, the cleaned byssus tuft is set for 24/36 hours in lemon juice. Afterwards it will be re-washed, dried and combed. This operation can also be done directly after the spinning process. We mostly use this procedure since it involves less loss of material.

We will always be grateful to the master Italo Diana for having passed on this ancient procedure which otherwise would have been lost and to the teachings of our *maestra* Efisia Murrone.

Dyeing wool and sea silk with purple pigment from *Hexaplex trunculus*

Inge Boesken Kanold

Introduction

Shellfish purple – or Tyrian purple as the ancients called it – has a history almost 4000 years old. The colour ranges from purplish-red, or fresh dried blood according to Pliny, to all shades of violet up to blue. Purple derives from different species of molluscs living in rather warm oceans all over the world. In antiquity though, mainly the Mediterranean Sea provided this precious dye for the robes of the elite. Throughout several millennia, purple was known as a dyer's colour and the pigment, the dry powder, available only as a result or by-product of a dyeing bath. Its quality and nuance were never quite predictable as the final product depends on many factors. It comes into being through contact with oxygen, in certain cases with light.

With the discovery of different red colours in the Middle-Ages, the purple industry declined, and the “savoir-faire” was lost, until recent research revived this colour of luxury.

Sea silk is another product of a mollusc endemic to the Mediterranean Sea, the *Pinna nobilis* L. Less well known, its history is as mysterious and the know-how of producing it was about to disappear. Of its fibre beard, called byssus, was said that it could be dyed with shellfish purple. An experiment, woollen fibres dyed together with byssus fibres, confirmed earlier try-outs: the wool reappeared in blue-violet-purple but the byssus fibres had simply changed to a slightly darker brown hue.

At the end of the Middle Ages and the beginning of the Renaissance, with the discovery of America, major changes occurred in the Old World. With the fall of the eastern Roman Empire in the middle of the 15th century, purple dyeing, which had existed since the 2nd millennium BC, declined and finally came to an end; the workshops were destroyed. The robes for the cardinals in Rome were now dyed with kermes, a red colour from insects, using the alum mines of Pope Paul II for the mordant. The cardinals' purple was replaced by scarlet red, as the esteemed purple garments from Byzantium were no longer available.¹ The consequence was the loss of the precious know-how of purple production. Even the purple dye procedure described by Pliny the Elder in the 1st century AD fell into oblivion. Revival attempts centuries later seemed

bound for failure because Pliny's observations were no longer understood.

Pliny's recipe

The purple of ancient civilisations, known as royal purple or Tyrian purple, had a supreme reputation.² Throughout antiquity, it was considered the most beautiful and most stable colour of all, a symbol of luxury and prestige.³ In his *Natural History*, Pliny the Elder described the procedure of purple dyeing as it was customary during the Roman Empire, giving posterity a fairly precise account of his observations. He left us a recipe:

"The vein already mentioned is then extracted and about a sextarius of salt added to each hundred pounds of material. It should be soaked for three days, for the fresher the extract, the more powerful the dye, then boiled in a leaden vessel. Next, five hundred pounds of dye-stuff, diluted with an amphora of water, are subjected to an even and moderate heat by placing the vessels in a flue communicating with a distant furnace. Meanwhile the flesh which necessarily adheres to the veins is skimmed off, and a test is made about the tenth day by steeping a well-washed fleece in the liquefied contents of one of the vessels. The liquid is then heated till the colour answers to expectations." (Plin., *HN IX*, 38)⁴



Fig. 8.1. From left to right: wool dyed with purple, sea-silk dyed in the same dye-bath, undyed sea silk (photo: A. Sicken).

Until recently, the procedure could not be replicated convincingly.⁵ Because translations and annotations were often erroneous, many trials ended in frustration. Pliny was a reporter, not a dyer; he told us what he saw without really understanding the procedure. He saw that 3 days were needed to achieve

the huge task of crushing thousands of shells before proper dyeing could begin. The glands, containing the precursor of purple, had to be cut out, an easy task that even children could perform. By adding salt, the fleshy mass was kept from decomposing too quickly and protected from an invasion of flies in a rather warm climate. Once “diluted with an amphora of water, [the glands in the vat] are subjected to an even and moderate heat” is perfectly correct. But the preceding sentence “then boiled in a leaden vessel” is the key to subsequent failures. Any attempt to boil the liquid will render successful dyeing impossible. A fruitful purple dye-bath needs the right alkalinity (which Pliny does not mention) and a moderate temperature during the several days of the dyeing procedure.

Reconstruction of a fermentation vat using fresh sea snails

In January 2001, the author was able to reconstruct a purple dyeing vat using fresh murex (*Hexaplex trunculus*) at the Conservatoire des Ogres et de la Couleur in Roussillon, France. She followed a procedure given by John Edmonds in his booklet *Tyrian or Imperial Purple Dye* which he presented for the first time in 2000 at the annual meeting of Dyes in History and Archaeology in Edinburgh.⁶ Experiments in 1999 at Reading University in the United Kingdom with a woad vat identified a bacterium, called *Clostridium isatidis*. It was responsible for the reduction process, the clue to any successful vat dyeing.⁷ Edmonds, who had participated in this research, based his theory on the principle that a bacterial action might have caused the reduction of the Tyrian purple dye. He used powdered dried glands which he had received from Israel, added cockles preserved in vinegar, employed the right temperature and proper alkalinity. It was the first successful old-style purple dyeing vat in centuries. In Edinburgh, we decided to repeat the procedure with fresh molluscs in southern France to confirm Edmonds’ findings. A week before the arrival of several specialists in ancient purple dye, including John Edmonds himself, the author started the dye-bath with *Hexaplex trunculus*. The shellfish, called “escargot de mer”, are a French delicacy and therefore available at local markets in Provence.⁸

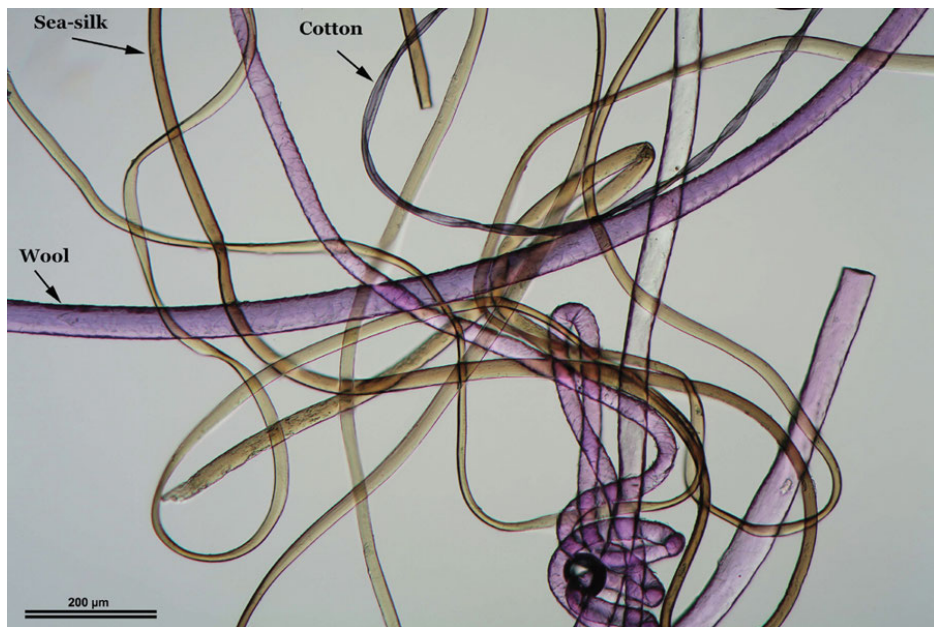


Fig. 8.2. Microphotography of sea silk, wool and cotton fibres dyed together in a purple vat (photo: P. Stähli).

Two kilogram of medium sized *Hexaplex trunculus* (about 100 molluscs) is a fair amount for 1.5 litres of water. Once the animals are collected or bought, they are cracked open with a little hammer or stone to extract a part of the fleshy material, called the hypobranchial gland. This organ contains the precursor of purple, at this stage a colourless secretion. The glands are cut out, added to water in a glass jar. There is no obvious need for salt or sea water. Almost immediately, the liquid will turn violet purple, but dyeing with this solution would be of very poor quality. Good results are only obtained if the dyestuff is reduced to its soluble form, called the *leuco* form, and is then able to penetrate the textile fibre. This reduction is achieved by adding potash until the alkalinity reaches a pH between 8 and 9. The vat is heated in a double boiler to approximately 50°C and kept under control, excluding light, for at least a week. After about 3 days, the initially violet coloured liquid turns dark green, a sign that reduction is on its way. Later, a yellowish nuance appears: the dyestuff is reduced. A piece of washed woollen fleece is immersed in the vat for a few hours (preferably overnight). Dipping the wool or the silk several times into the dyeing vat increases the darkness of the colour. But the vat needs a rest of several hours before attempting another immersion. To achieve a very deep shade, however, it is better to prolong the dyeing time and to use a very concentrated vat.

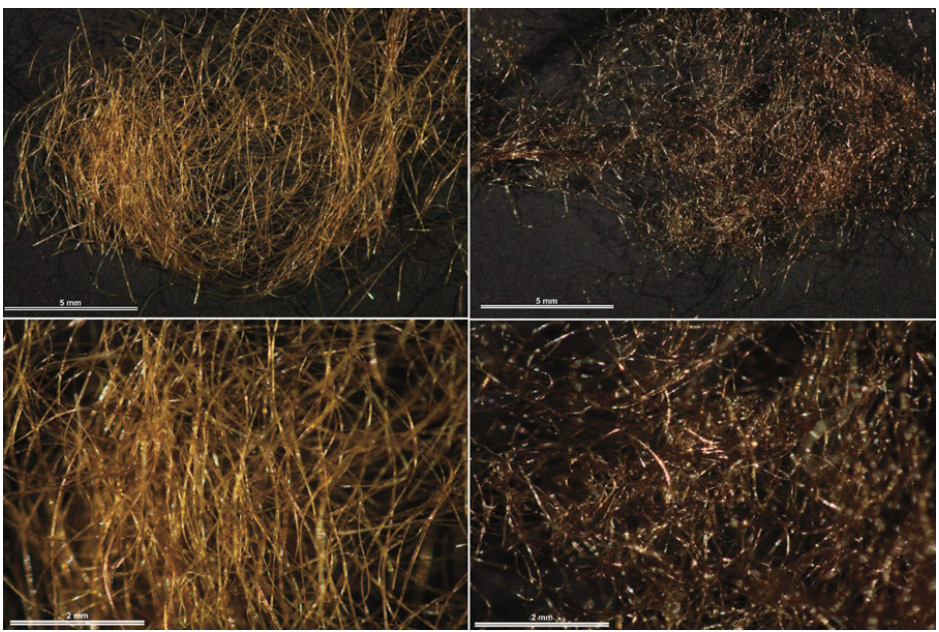


Fig. 8.3. Left, sea silk undyed; right, sea silk dyed with purple (photo: P. Stähli).

When taken out, the wool – now greenish-yellow in colour – is squeezed in the hand (gloves recommended) to avoid exposure to strong light and then transferred into a covered container with water for about an hour. There it oxidises to its final colour, a deep violet. If the same procedure is carried out without protection from daylight, the result is most likely a bluish coloured specimen. Experience shows that the outcome of a purple dyeing bath varies greatly depending upon the amount of glands used, the freshness of the molluscs, and their provenance. If the dye-bath is close to exhaustion, a wool sample comes out blue.

Dyeing with *purpurissum*, a purple pigment

A fermentation vat, as mentioned above, needs 7–10 days to mature. A reduced vat is very smelly, precluding transportation by plane or train. Therefore, it was decided for the workshop in Lecce, that purple pigments should be used to make travelling much pleasanter. In his *Natural History*, Pliny called this product *purpurissum*, or the *painter's paint*, (Pliny, NH XXXV, 44).⁹ He suggested that *creta argentaria* can be used to adsorb the colourant within a vat. Different try-outs led to a simplified version. Fresh glands of *Hexaplex trunculus* were cut out and placed into water in a Petri dish; it turned violet rather quickly. At this stage it was helpful to use a mixer to blend the glands in order to liberate the water soluble precursors. Various substrates like calcium carbonate, aragonite, and *gofun* (ground or crushed oyster shells) were added, but only acidic insoluble white pigments such as talcum powder (magnesium silicate) were found suitable. The remains of the fleshy material and other shell debris, which always stick to the separated hypobranchial glands, had to be discarded.

Vinegar, or more efficiently, diluted hydrochloric acid, was used for the hydrolysis and separation of the unwanted residues. Continuous heating of the extracts (up to 50°C) helped to accelerate the cleaning process. After that, careful washing with water removed the acids to obtain a neutral product. Once filtered and dried, this purple powder is a paint (when used with a binder) or a dye (when reduced with sodium dithionite).¹⁰

Dyeing byssus fibres with purple

Sea silk is a product of another mollusc, the bivalve *Pinna nobilis* L. which is endemic to the Mediterranean Sea. It has a kind of fibre beard, called byssus, with which the animal attaches itself to the ground. Once harvested, cleaned and carded, the beard can be treated with lemon juice providing a honey-like colour to the fibres. Other descriptions call them golden threads, olive coloured and shining byssus. Byssus was known since antiquity, though the word did not stand for sea silk, but for a fine textile of linen or cotton (see Maeder, this volume). Similar to the purple production, the know-how was largely lost. In Sardinia and in Apulia, southern Italy, the knowledge was kept alive until the middle of the 20th century. A publication by Beniamino Mastrocinque in 1928, entitled *Bisso e porpora*, described in detail the fishing of the *Pinna* shell and the processing of the byssus fibres to sea silk by local women. Also, purple snails were caught and their juice directly applied to linen handkerchiefs and then photographed.¹¹ In 1998, Felicitas Maeder began research on sea silk, a topic nearly forgotten then. She collected the few sea silk textiles still to be found in natural collections worldwide. They were generally knitted items such as gloves, caps, stockings, or small embroidered or fur-like textiles. Some years later, in 2004, she presented the result of her work in an exhibition at the Natural History Museum of Basel.¹² Since then, research on sea silk is ongoing. The Lecce meeting enabled a small group to witness the coming-to-life of two of the great myths.

We wondered whether byssus fibres could be dyed purple? This question has stirred scholars before. Experiments in the 19th century were unsuccessful. Byssus fibres would not accept another colour without losing its own sheen.¹³ Those comments were generally confirmed by authors in the 20th century. Rita del Bene, living in the '30s in Taranto, a coastal city in southern Italy, initiated a school for women preparing and weaving sea silk. She was convinced that dyeing byssus fibres was possible, but there is no proof of a purple coloured piece.¹⁴ Luciana Basciu claims that byssus fibres can be dyed with *Stramonita haemastoma* which is one of the purple giving murex, but this leads to the question: why not with *Hexaplex trunculus*?¹⁵ In Sant'Antioco, a village in Sardinia, several women still know how to prepare the tiny filaments and spin them into threads. At the Lecce meeting, Giuseppina and Assuntina Pes from Sant'Antioco demonstrated the preparation of byssus fibres to sea silk (see [Chapter 7](#)). At the same place the Ethnographic Museum and Chiara Vigo's

Museo del bisso show instruments and the process of making sea silk. Nonetheless, the *Pinna nobilis* L. is protected and byssus has become a rarity.

In 2010, Felicitas Maeder asked the author to dye and paint tiny pieces of sea silk with purple pigment. The experiments failed, the result was an unattractive brownish tint when dyed. When painted with the pigment, a heavy coat of purple covered the fibres.

These questions stimulated our curiosity during the workshop. The preparation of the dye-bath started the night before the demonstration. Ten grams of *purpurissum* were soaked in a jelly jar with warm water. Two grams of caustic soda (NaOH) were added to increase the alkalinity of the medium and the next day, some 3 g of sodium dithionite (Na₂S₂O₄).

Within 30 minutes, the reduction process started, well defined by its yellow liquid. The dye-bath, contained in the loosely closed jar, stood in a double boiler covered with a lid to avoid light. Temperature and alkalinity were controlled. With Felicitas Maeder, we decided to dip wool and byssus fibres together into the same dye-bath. A small piece of sea silk embedded in a little woollen cloth, tied together, was immersed into the reduced liquid. Would it eventually turn out purple?

Meanwhile, as we had to wait for an hour, fresh murex – very large and healthy looking specimens from the nearby Mediterranean sea – were cracked open by many participants either in a mortar using a stone pestle or on the hard floor with a simple stone. Only a few of them knew how to obtain purple, so this was a perfect opportunity to witness this strange phenomenon. They hit the shell opposite the natural opening and so exposed the hypobranchial gland. The gland, which contains the precursor of purple – as we have seen, in form of a colourless secretion – is very discrete. It has, if the mollusc is fresh and alive, a texture and colour reminiscent of shrunken fine muslin. For those who had never observed the purple metamorphosis it was a unique moment. First, the location of the hypobranchial gland had to be detected. Dipping their brushes into the gland, they then applied strokes onto little cotton squares. Carried away, some started drawing on the fabric. Within minutes, one could watch the changes from white to yellow, to green to blue, followed by a dark purple shade.

While the painting experiments were going on, the sea silk in the woollen cloth was soaking in the dye-bath. When time had arrived, all eyes were set upon the little wet lump which emerged from the vat. It was quickly squeezed half-dry, then dipped into water and covered, so the colour could develop undisturbed. With *Hexaplex trunculus*, oxygen is sufficient to perform the changes from yellow to green, to blue and then to a violet purple. The little bundle was pulled out of the water and opened: the woollen cloth was dyed blue violet purple, but the byssus had only deepened in its brownish hue. All the honey-like appearance once again had disappeared. We had our answer.

Conclusions

Dyeing techniques are no longer a mystery or the secret of antiquity.¹⁶ Pliny's ancient dye-bath has been elucidated, repeated and updated. Using modern implements like a mixer or a heating plate, a pH meter or even chemicals such as sodium dithionite can aid the process. The dyeing method for purple works, and textiles of all sorts can be dyed if desired. Sea silk, however, does not seem to take to being dyed in a purple vat. It's honey, golden or olive-like colour cannot be improved upon.

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1 Reinhold 1970.

2 Cardon 2007; Haubrichs 2004; 2006.

3 Steigerwald 1986.

4 Bailey 1929.

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8 Boesken Kanold 2005.

9 Bailey 1932.

10 Boesken Kanold 2011.

11 Mastrocinque 1928.

12 Maeder *et al.* 2004.

13 Heinzelmann 1852; Cloquet 1861.

[14](#) del Bene 1937.

[15](#) Basciu 1997.

[16](#) Meiers 2013.

Recent advances in the understanding of the chemistry of Tyrian purple production from Mediterranean molluscs

Chris Cooksey

Despite extensive investigations into Tyrian purple, the exact chemical nature of its major component remained a mystery until the early 20th century. In 1909 Paul Friedländer isolated 1.4 g of the compound from 12,000 *Murex brandaris* and determined that it was 6,6'-dibromoindigo. Colourless precursors in the hypobranchial gland of the mollusc undergo rapid changes when the mollusc dies leading to changes in the colour – yellow, green, blue and finally purple, as observed long ago (Cole 1683). The blue to purple change is caused by molecular stacking. The identity of the colour precursors was uncertain until chromatographic techniques became available in the 1950s. They are bromoindoxyl sulphates. The key intermediate, tyriverdin, was identified in 1978. This yellow compound is photosensitive and decomposes in sunlight to give dibromoindigo and dimethyl disulphide. The legendary stench associated with this process is, quite likely, not due to this sulphur compound, but to dimethyl trisulphide. The confusion caused by some translations of Pliny's 1st century AD description of the purple dye-bath has been resolved (see also [Chapter 8](#)). After the rapid generation of the dye, a slower biochemical reduction occurs, optimally at 50°C and pH 9, leading to the water soluble leuco-6,6'-dibromoindigo. Wool or silk, added to the bath, absorbs this leuco compound which, after exposure to air, is oxidised back to the dye. But some mysteries remain, especially concerning *Murex trunculus*.

The early days

The production of Tyrian purple on a significant scale in the Mediterranean started, perhaps, about 2000 BC in Crete. Two thousand years later, the process was described by Pliny the Elder in some detail and this text has been pored over by scholars ever since, hoping to understand how it was done. Some authors consider that Pliny was not all that reliable. For example, Rachel Vykukal suggests:

“Even though Pliny the Elder's account is the most complete account of purple dye production we have, it is highly unlikely that Pliny actually observed this process. We know from his nephew, the Roman author Pliny the Younger, that Pliny was more of an armchair naturalist, who did not experiment or analyze

himself, but instead based his writings on information from earlier authors”.¹

Using the 1855 translation by John Bostock and H. T. Riley of Pliny’s description, the procedure is, in summary, as follows.² The hypobranchial gland is extracted from the fresh mollusc, the glands are soaked with salt and water for 3 days and then the mixture is boiled in a tin vessel. The product is warmed at an “even and moderate heat” for at least 10 days and then degreased wool is dipped in for 5 hours. Unfortunately, this recipe cannot be successful for reasons discussed later (and see also [Chapter 8](#)).

The industry spread all round the Mediterranean Sea, but contracted as the Roman Empire shrank, and was finally extinguished when the Turkish hero Sultan Mehmet II released Constantinople from the Christian yoke on 29 May 1453 ([Fig. 9.1](#)).³

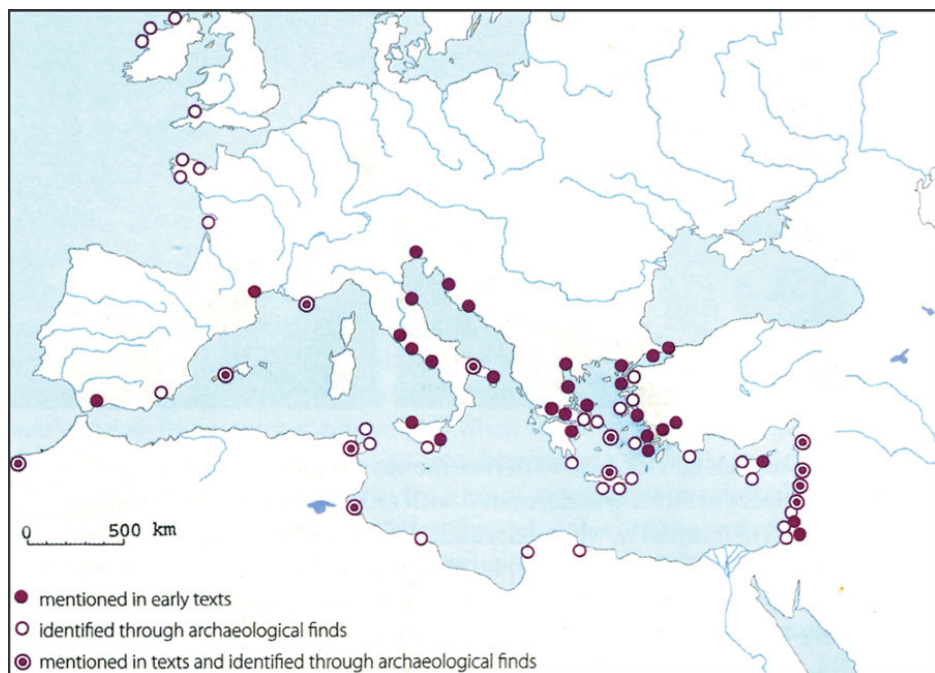


Fig. 9.1. Centres of purple dyeing in the ancient Mediterranean world (Cardon 2007, 574, fig. 3).

The three routes to the purple

Pliny’s recipe clearly describes the preparation of a vat dye, viz. a bath into which a textile is dipped and when removed and exposed to air, the colour develops. But, surprisingly, he does not mention this spectacular feature. An analogous process was used to dye with indigo, an equally historic dye. The indigo dye-vat has been described by numerous authors.⁴

The second route is the direct application of the hypobranchial gland to a textile or any other surface, even fingernails, followed by exposure to sunlight. Paul Friedländer (1857–1923) used this route, applying the glands of 12,000

Murex brandaris to filter paper from which he isolated and identified 1.4 g of the major component of the purple pigment as 6,6'-dibromoindigo.⁵ Ingold comments:

“The tedium and unpleasantness associated with the dissection of the thousands of molluscs necessary in order to obtain enough colouring matter to work with is, however, bound to turn aside any but the most determined investigators”.⁶

The third route, leading to a pigment which was used in wall paintings, is quite likely to be just the first step in Pliny's recipe, but it has received much less attention than the first two.

The colour changes

The development of the colours of the hypobranchial gland contents during exposure to sunshine has long been documented.⁷ The chemistry behind the colour changes (Fig. 9.2), at least for *Murex brandaris*, can now be explained.⁸ When the mollusc dies, the colourless precursor of the purple, tyrindoxyl sulphate, is released and is rapidly desulphated by an enzyme, purpurase, to give tyrindoxyl. Tyrindoxyl sulphate was first isolated from *Murex brandaris* in 1954, but not fully characterised until 1968 by Baker and Sutherland who obtained it from the Australian muricid *Dicathais orbita*.⁹ Next, the tyrindoxyl is oxidised by oxygen in the air to give the orange intermediate tyrindoleninone which dimerises to give tyriverdin, first identified in 1978, which is yellow.¹⁰ As soon as tyriverdin is exposed to light, it is decomposed to give dibromoindigo and dimethyl disulphide. The dibromoindigo is initially blue and the combination of yellow and blue colours gives green, so tyriverdin, as the name suggests, always appears to be green. Finally, the blue to purple transition is caused by molecular stacking of the dibromoindigo molecules aided by van der Waals attraction (Fig. 9.3).¹¹



Fig. 9.2. The colour changes observed on exposure of the hypobranchial glands of *Murex trunculus* (left) and *Murex brandaris* (right) to sunlight (de Negri and de Negri 1876, tav. 8).

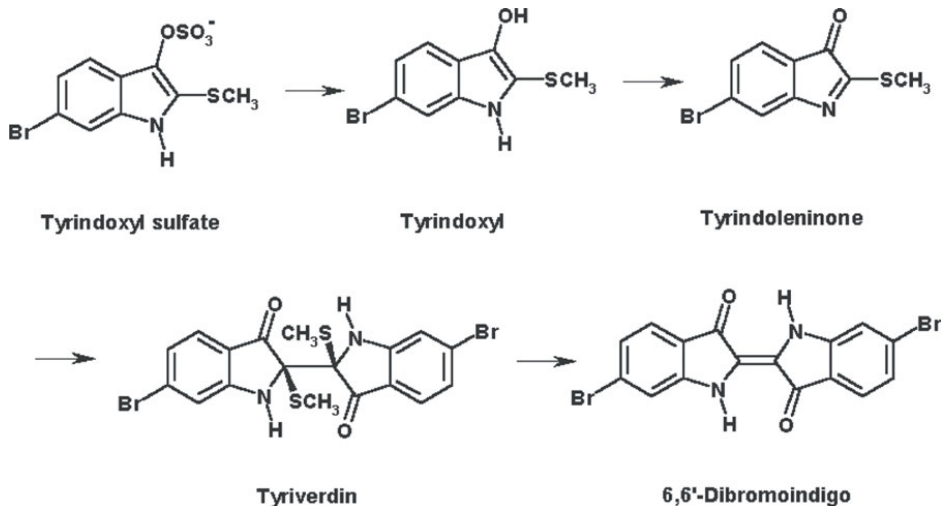


Fig. 9.3. The chemical transformations of tyrindoxyl sulphate in *Murex brandaris* leading to the purple pigment, 6,6'-dibromoindigo.

While the colour from most purple producing molluscs is purple, that from *Murex trunculus*, as can be seen in Figure 9.2, is more blue. The composition of this pigment is quite variable and in addition to 6,6'-dibromoindigo, can contain indigo (0.4–56%) and 6-bromoindigo (6–49%) as well as smaller amounts of bromoindirubins. Some researchers have found that the pigment can be blue or purple depending on the sex of the mollusc, but different authors reach contradictory conclusions.¹²

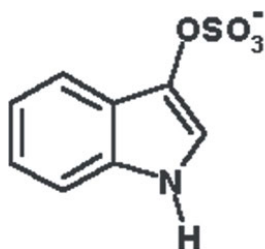
The precursors in the mollusc

In 1971, Fouquet and Bielig reported that four indoxyl sulfate precursors were contained in *Murex trunculus* (Fig. 9.4).¹³

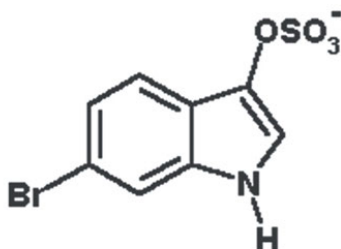
Fouquet and Bielig claimed that the single precursor found in other Mediterranean molluscs, *Murex brandaris*, *Murex erinaceus* and *Purpura haemastoma* was compound 4, but this has never been confirmed. Later, in 1974, Baker demonstrated the power of chromatography to determine the number of colour precursors in the mollusc.¹⁴ He showed that *Dicathais orbita* and *Murex brandaris* contain the same single precursor, which was previously convincingly identified as tyrindoxyl sulphate. *Murex trunculus* contained four different precursors, one giving a blue spot (indigo) which was identified as indoxyl sulphate, and three others which gave purple spots, i.e., were brominated. Fouquet and Bielig's reported precursors would give a different result: two blue and two purple spots. Baker's experiment also showed that *Purpura haemastoma* and *Rapana bezoar* contained two purple precursors, different from all the others, and *Murex erinaceus* yet another single different precursor (Fig. 9.5). Clearly, the many unanswered questions need further investigation.

The dye-vat

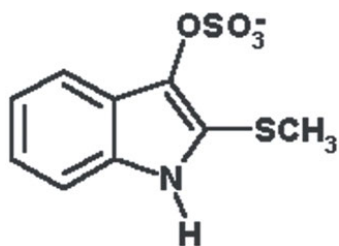
After the three-day soaking, leading to water-insoluble indigos, the next step is the reduction of the indigos to water-soluble *leuco*-indigos which can be used for dyeing textiles. Chemists searched for some years to discover the identity of the reducing agents. Various candidates were considered, including lead, tin, thiols, sulphur compounds in wool and honey, but none was very convincing.¹⁵ The problem was resolved by a retired engineer, John Edmonds, who had studied the woad vat in which indigo is reduced to *leuco*-indigo by bacteria, specifically *Clostridium isatidis*. He demonstrated that dibromindigo, derived from mollusc sources, could be reduced in an exactly analogous way using just mollusc flesh after 4 days at pH 9 and 50°C.¹⁶ There are two other necessary requirements: the vat needs to be oxygen-free otherwise the *leuco*-indigos are oxidised back to indigos, and sunlight needs to be excluded otherwise *leuco*-bromindigos are photodebrominated. And no boiling, which would destroy all the bacteria, is necessary. Given these parameters, others were able to confirm the successful reproduction of Pliny's dye-vat.^{17, 18}



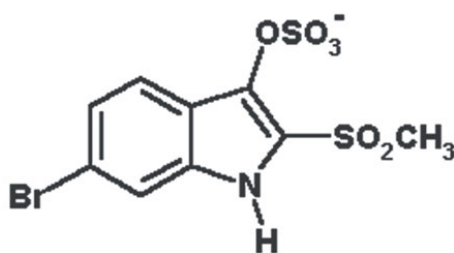
1 (45%)



2 (30%)



3 (5%)



4 (20%)

Fig. 9.4. The colour precursors in *Murex trunculus* as suggested by Fouquet and Bielig (1971, n. 14).

The smell

The legendary stench generated in sunlight, apart from that from *Murex trunculus*, is usually identified as dimethyl disulphide. But this might not be the case and the major cause of the smell could be dimethyl trisulphide, as was

demonstrated for the fragrance from the titan arum (*Amorphophallus titanum*) using gas chromatography – mass spectrometry – olfactometry (GC-MS-O).¹⁹ Although dimethyl disulphide is present in larger amounts in this plant, it does not contribute significantly to the smell.

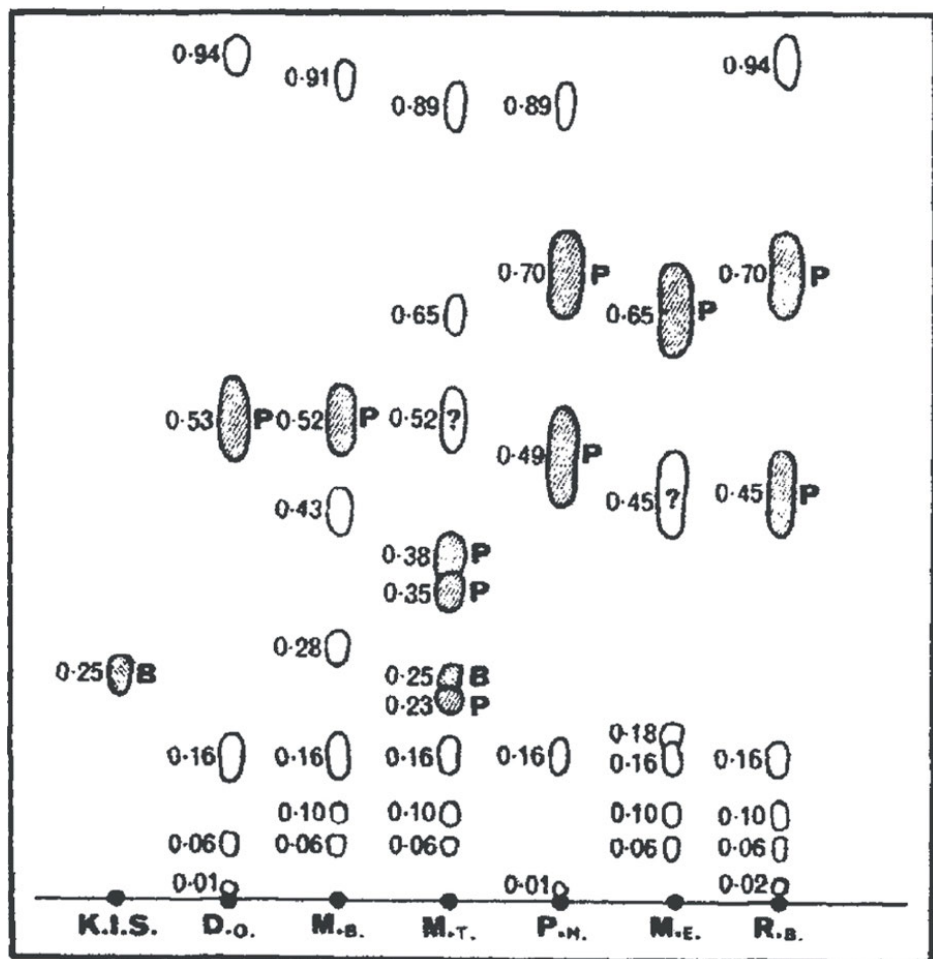


Fig. 9.5. Paper chromatography of ethanol extracts of the hypobranchial glands of *Dicathais orbita* (Do), *Murex brandaris* (Mb), *Murex trunculus* (Mt), *Purpura haemastoma* (Ph), *Murex erinaceus* (Me) and *Rapana bezoar* (Rb), with potassium indoxyl sulphate (K.I.S.) B = blue, P = purple (Fouquet and Bielig 1971, n. 15).

Conclusion

The last hundred years has seen much progress in understanding of the chemistry of Tyrian purple production. But some mysteries remain, especially concerning *Murex trunculus*.

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1Vykukal 2011.

2Plin., *HN* IX, 62: how wools are dyed with the juices of the purple.

3Cardon 2007, 553–606.

4For example: Partridge 1834, 68; Napier 1853, 337; Edmonds 2003, 66–73.

5Friedländer 1909.

6Thorpe and Ingold 1923, especially p. 18.

7Cole 1685.

8De Negri and De Negri 1876.

9Bouchilloux and Roche 1954; Baker and Sutherland 1968.

10 Christophersen *et al* . 1978.

11 Cooksey and Sinclair 2005.

12 Westley and Benkendorff 2008.

13 Fouquet and Bielig 1971.

14 Baker 1974.

15 McGovern and Michel 1990.

16 Edmonds 2000.

17 Boesken Kanold 2005.

18 Koren 2005.

19 Shirasu *et al* . 2010.

Mari(ne) purple: western textile technology in Middle Bronze Age Syria

Elena Soriga

The cuneiform archives of Mari (18th century BC), in the Middle Euphrates region, shine light on the strong commercial links with Crete, Cyprus as well as the Semitic kingdoms of Yamkhad, Qatna, Ugarit, Byblos and Hazor. Minoan Kamares pottery was discovered in all these cities, providing material evidence of a blossoming overseas trade between communities in the Middle Bronze Age Syria, Canaan and Aegean.

Moreover, in spite of large-scale textile production within the kingdom, the texts of Mari record the importation of wool, textiles and fabrics from the above-mentioned western cities and from the island of Crete. The cuneiform tablets reveal a particular appreciation for “Mediterranean fashion” though they do not provide any indication of why. The discovery of an original western typology of loom weights in the Middle Bronze Age II levels of some Canaanite sites suggests that at the time of the Mari archives there was a sort of “textile technological *koinè*” based on the circulation of new techniques and unknown raw materials. Archaeomalacological remains prove that the first production of molluscan purple dye comes from some coastal sites in Crete and the Aegean Sea and dates back to the beginning of the 2nd millennium BC. Mediterranean purple may have been a determinant factor in the development of the cultural and commercial relations recorded in the archives of Mari. Such a hypothesis could be supported by a few texts from Mari where, for the first time, the word *tabarru* is recorded in its syllabic writing. This term occurs to denote a particular nuance of red wool that, since the middle of the 2nd millennium BC, is often quoted besides other denominations of purple. In this paper the term *tabarru* will be analysed and its early attestations contextualised to the ecological framework and cultural horizon of Middle Bronze Age Syria.

Ex oriente purpura: outdated theories on the Near Eastern origin of marine purple dye

For a long time scholars connected purple dye with the ancient Near Eastern world and particularly to the Levantine and Canaanite cultures.¹ The textual sources of the 1st millennium BC provide much evidence confirming the existence of this link. In its blue and red shades, purple is often mentioned in the Old Testament among the luxury goods used as attributes of royal power by

the great monarchs with whom the Children of Israel came into contact.² In Chronicles and Exodus, Yahweh himself requested textiles dyed with purple for the edification of his temple and the erection of the Holy Tabernacle.³ In certain Biblical passages the origin of purple-dye technology is located in the Levantine lands, mostly in the Canaanite, Phoenician and Philistine centres and in the areas controlled by the cities of Tyre and Hazor (see Fig. 10.4, below).⁴

Western literature too has contributed to the “Oriental” connotation of this prestigious dye. In his epics, Homer praises the skill of the Sidonian women, able in making fine polychrome (Gr. *pampoikila*) handiworks whereas according to other sources, Sidon is “renowned for its purple dye”.⁵ In later centuries, Roman poet Horace remarks on the superiority of Sidonian purple and the historian Strabo states that no ancient brand of purple is “more brilliant than the purple of Sidon”.⁶ Moreover, Greek and Roman authors reported on the myth of the god Heracles/Melqart who had fallen in love with the nymph Tyre and had made her a wonderful dress dyed with the pigment, accidentally discovered when his dog was munching a murex snail on the promenade in front of the city of Tyre.⁷ In its deep red hue, “Tyrian purple” was considered the most precious variety of purple in the Classical world and because of its superfine quality it was also defined “Imperial Purple”.⁸

The cuneiform texts of the 1st millennium BC strengthened the Biblical and Classical traditions that identify the countries bordering the Eastern Mediterranean Sea as the land of purple.

A Neo-Assyrian text records the booty conquered by the army of Tiglath-Pileser III in Syria and Palestine (733–732 BC). The tribute list includes: “polychrome cloths, linen garments, red-purple wool (Akk. *argamannu*), and blue purple wool (Akk. *takiltu*)” but also “living sheep whose wool is dyed with red purple and birds flying in the sky whose wings are dyed of blue purple”.⁹ No doubt this quote may be considered a hyperbole used to boast of the Assyrian Emperor’s mightiness and power, as he was able to assemble the most sumptuous, exotic and bizarre items from all of his dominions. Nevertheless, the text also shows that, at that time, purple technology was well developed in Canaan, because the dyes were the most important and characteristic tributes of this land.

Furthermore, philologists have found etymological links between some Levantine toponyms and several names provided by ancient textual documentation indicating marine purple dye. According to some scholars the coronym *Phoînîkē* “Phoenicia” and the related ethnicon *Phoînîx* “Phoenician” derived from one of the terms used in the 1st millennium BC to connote purple dye (Gr. *phoînîx*), whose Phoenicians were famous for trade.¹⁰ Analogously, the qualification of Canaan – in the 1st millennium BC the territory corresponding roughly to Phoenicia – as “Land of Purple” was based on the relation between the coronym and the Hurrian word *kinahḫhu*, in Akkadian texts from Nuzi a

term designating a red colour/dye.¹¹

Current scientific research however rejects the traditional model according to which the discovery of purple was due to the inventiveness of the Phoenician or Canaanite societies. Purple is no longer considered a Levantine innovation or a typical commodity solely of the ancient Near East. The consistent archaeological discoveries of new texts and purple dye work areas, the introduction of modern methodologies and the increasing and widespread recourse to an interdisciplinary approach are all factors that revolutionized the studies regarding purple dye in antiquity.

Analyses of the shattered shell middens of the three Mediterranean gastropod species (*Hexaplex trunculus*, *Bolinus brandaris* and *Stramonita haemastoma*) of murex snails (Fig. 10.1) whose hypobranchial gland contain the pigment of purple (dibromoindigo) have allowed malacologists and archaeologists to declare that the most ancient production centres of purple dye were situated along the coast of the Aegean and not in the Levant.¹²

The first archaeological evidence of murex snail exploitation for dyeing came from the Early Bronze Age levels at Aegina in the Saronic Gulf.¹³ Apart from this case, the majority of sites in which crushed murex shells or purple-dye residues have been found are in Crete and belong to the Middle Bronze Age.¹⁴ The heaps of crushed murex found in the Anatolian city of Troy (18th century BC) date back to this same period, as do the heterogeneous materials from Pyrgos-Mavroraki (c. 19th century BC), on the southern coast of Cyprus.¹⁵ This site preserved vestiges of industrial facilities devoted to luxury goods production, among which were perfumes and textiles. In the so-called “Textile Room” two vats with dibromoindigo residue and a spindle whorl containing a tangle of fibres dyed with marine purple were found.¹⁶ These findings demonstrate that marine purple-dye technology originated in certain circumscribed areas of the Aegean from the second half of the 3rd millennium BC, spread quickly along the Anatolian and Levantine coasts of the Eastern Mediterranean at the beginning of the 2nd millennium BC.



Fig. 10.1. Extraction of indigoid from murex molluscs. Top: the hypobranchial glands of *Hexaplex trunculus*. In the middle, left: a dyeing vat containing hypobranchial glands; right: direct painting of a wool fabric by coating murex gland. Below, left: the exposing to the air of the dyeing vat and the threads of wool contained in it and the turning of their colour from the yellow-greenish shades to the bluish one. Below, right: purple painted squares with different exposure to the air and sun; the yellow square shows the early stage of the change colour of every kind of marine purple, the red one the final stage of the purple from *Bolinus Brandaris* and the violet and blue squares show that of the dye from *Hexaplex trunculus* (photos: E. Soriga).

Concerning continental evidence of Near Eastern purple, the most ancient sources date back no earlier than the Late Bronze Age. Crushed murex heaps found at Minet el Beida, the ancient harbour of Ugarit, in modern Syria, were dated by archaeologists who conducted the excavations, to a period before the

16th century BC, but this early chronology is still a controversial issue among scholars.¹⁷ The first direct evidence of Near Eastern purple comes from a tomb of the Royal Cemetery of Qatna (16th–14th centuries BC), the modern Tell Mishrifeh in Syria, where the remains of a purple-dyed fabric were found.¹⁸ Six Canaanite storage jars or vat/basin fragments with dibromindigo residue and shattered *Hexaplex trunculus* shells -some with purple residues-were found in the Phoenician site of Sarepta (14th–12th centuries BC) in the Lebanon.¹⁹ Other murex shell heaps were found in one of the most important harbours of Hazor, the Canaanite site of Tell Akko, in the northern part of Israel, an area quoted in the Bible as being the original site of the tribes skilled and specialized in textiles coloured with purple and other precious dyes.²⁰ Before the 1st millennium BC the latest evidence of the Near Eastern purple-dye industry is in Cyprus, at the site of Hala Sultan Tekke (12th century BC).²¹

By then, several philologists neglected the aforesaid reconstructions and discounted them as folk etymologies.²² There is no doubt that the name *phoînix* indicates a shade of the red colour, since it derives from Mycenaean *po-ni-ki-jo*, an adjective pertaining to dyed fabrics in the Linear B texts, and it is related with the Gr. *phoinos* ‘a blood red colour’.²³ Nevertheless, many scholars refused to recognise marine purple as the dyestuff used to obtain this colour, proposing that the deep red colour was extracted from the roots of a plant, madder (*Rubia tinctorum*) rather than from sea snails.²⁴ In favour of these arguments, in the above-mentioned Mycenaean tablets, beside *po-niki-jo*-cloths there is the attestation of coloured textiles qualified as *po-pu-re-ja/po-pu-re-jo*.²⁵ The adjective displays clear relations with the Gr. *porphyra* and the words used by modern languages to designate both colour and dye purple. Moreover its etymology, linked with the Greek verb *porphirô* “to seethe, to boil”, might be interpreted as a reference to the technical procedure for extracting the dyestuff from marine gastropods described by Classical authors.²⁶ According to Pliny marine purple was obtained by soaking the crushed snails in water for a few days and heating up the resulting solution from which was continually skimmed a froth of organic residues.²⁷

With regard to the alleged link between the Land of Canaan and the colour/dye *kinahhu*, this latter term has been related to the Heb. *ke na’an*, attested to with the meaning of “merchant” as early as the 15th century BC and quoted eight times in the Old Testament.²⁸ This etymology does not rule out a secondary association between purple, a major commercial product around the middle of 2nd millennium BC, and the area of Canaan: “the land of the merchants, dealers in purple dye”. It would thus illustrate the basic importance of the trade in coloured fabrics. Nevertheless, the direct link between the place-name Canaan and *kinahhu*-purple dye continue to be a still questionable issue.²⁹

Cuneiform documentation corroborates the later chronology for Near Eastern purple: the texts in which purple textiles are quoted do not precede the

second half of the 2nd millennium BC, when murex shells and dibromoinidigo residues appear at archaeological sites. Tablets in which purple is mentioned are the archives of Nuzi and Alalakh IV (last quarter of 15th century BC), El-Amarna (mid-14th century BC), Boğazköy (13th century BC) and Ugarit (13th century BC).

The terminology of purple dye: an early attestation of the word *tabarru*

In cuneiform texts purple is known as a colour and not as a raw material: the term is used not as a noun but as an adjective to describe dyed wool and coloured textiles. Syrian-Mesopotamian terminology is extensive because it reflects the wide chromatic spectrum that secretions produced by murex snails achieved during the processing of the dye. In contact with air and light, the base of molluscan purple changes colour. It turns from a colourless to a yellow-greenish tint, characteristic of very indigoid reduction, reaching then the blue-violet or magenta hues in accordance with the species and even the gender of the molluscs (Fig. 10.1).³⁰ Besides that, the use of different substances as reducing agents used in order to create alkaline conditions and solubilise the indigoids in water may affect the gradation of the colour.³¹ Furthermore, often ancient texts called “purple”, the colours whose hue is very similar to the shades of the dye extracted from sea snails, even when the dyestuffs derive from other natural resources and less expensive substitutes.³²

In his fundamental study of colours in cuneiform documentation, Benno Landsberger (1967) recognized as “purple” only a few terms linked with the two most quoted nuances of the dye that occur in 2nd and 1st millennia texts, namely blue purple and red purple. According to the scholar, the names for the different nuances of purple are composed by the ideogram SÍG.ZA.GÌN, where the logogram ZA.GÌN, preceded by the determinative for minerals NA4, indicates lapis lazuli stone.³³ Indeed the signs also form several names of colour, perhaps denominations for different hues of marine purple or, more likely, other colours obtained from alternative dyestuffs associated with genuine purple for their shining and fastness.³⁴ In the Ugarit texts the logogram SÍG.ZA.GÌN occurs followed by *uqnû* ‘lapis lazuli’ (Akk. *takiltu*), to denote blue purple wool, whereas before *phm* (Akk. *ḥašmānu*) it indicates red purple ones.³⁵ During the 1st Millennium BC, the ideogram ZA.GÌN was gradually dropped, leaving only the phonetic spellings.³⁶ In Neo-Assyrian texts, the term *ḥašmānu* is replaced by *argamannu* (SÍG.ZA.GÌN.SA5), a denomination often mentioned besides the *takiltu* (SÍG.ZA.GÌN.MI) blue purple colour, which is used to denote the red-purple colour.³⁷ These terms are recognisable in the Hebrew *tekhelet* and *argaman*, translated in the Septuagint with the Greek terms *hyakinthos* and *porphyra* respectively.³⁸ But dyed textiles described with the logogram SÍG.ZA.GÌN = *šipātu uqnû*, literally “lapis lazuli wool”, occur already in some Early Dynastic texts, and consequently they belong to a period in which purple

technology was not yet known at least in the Near East.³⁹ It is likely that in this early period the term indicated deep violet-blue fabrics obtained with dyeing substances of vegetal origin.⁴⁰ In this geographical and historical context the most probable candidate is woad, extracted from the leaves of *Isatis tinctoria* (Syr. *qān'ā*, *qe nā'ā*; Akk. *uqnātu*, *šammu qunātu*; Sum. *Ú.ZA.GÌN.NA*), an indigo-bearing plant native to Western Asia and widely used in antiquity.⁴¹ Only from the 2nd millennium BC, when marine purple technology spread throughout the Levant and Mesopotamia, did *SÍG.ZA.GÌN* (occasionally *SÍG.ZA.GÌN.GE6*) become the standard term to designate blue purple colour, with the Akkadian reading *takiltu*.⁴² In Neo-Babylonian texts the correspondent logogram *SÍG.ZA.GÌN.KUR.RA* might suggest that *takiltu*-wool was coloured by using an exotic dyestuff coming from outside the borders of Mesopotamia.

Analogously, red purple is expressed by the logogram *síg ZA.GÌN.SA5*, literally “wool dyed with (a substance of the same value?/colour?/sheen? as) lapis lazuli – but red”.⁴³ Its phonetic spelling is the Akkadian *argamannu*, the only term related by B. Landsberger to the genuine purple-dyestuff.⁴⁴ In the Assyriologist's opinion other designations for reddish shades of purple have probably nothing to do with the dye produced from marine gastropods.⁴⁵ He excludes, for instance, the terms *kinahḫu* and *tabarru*, traditionally considered names meaning hues of the red purple dye.⁴⁶

The word *tabarru* (var. *tabar[u]*, *tawarri-wa*) is very controversial. Some Assyriologists agree with B. Landsberger, translating it simply as “red wool” in virtue of the logographic writing *SÍG.ĤÉ.ME.DA/ SÍG.GAN.ME.DA*.⁴⁷ Nevertheless, other scholars prefer to translate it as “red purple”.⁴⁸ According to the latter cited opinion, *tabarru* might indicate a dark hue of red purple, obtained by mixing genuine purple with madder, or other vegetable dyestuff.⁴⁹

A similar shade of purple is described in the 1st Century AD by Pliny who reports that Phoenician dyers manufactured dark purple cloths by using the technique known as *dibapha* “twice dyed” or otherwise *dibapha Tyria*.⁵⁰ Several times this practise is quoted in Exodus, where genuine purple is blended with kermes.⁵¹ Adulteration and imitation of the molluscan purple dyes, by mixing or replacing a certain amount of genuine purple with cheaper surrogates, was actually a common practice in the ancient Near East. The Papyrus Graecus Holmiensis and Papyrus Leidensis X, alchemical texts written in 3rd century AD Egypt, provide recipes for imitations of Royal Purple.⁵²

In Mesopotamia, thus far away from the Mediterranean shores, the Neo Babylonian tablet BM 62788, recently joined to BM 82978, supply direct practical instructions to dye wool in different shades of “purple”.⁵³ The dyeing of the wool was repeated two or three times, by soaking the fibres in hot water and different colouring agents. The *tabarru* colour was obtained by dipping the wool, previously dyed in a “blue light” colour (*urriqu*), in a solution of water heated with alum and red dyestuffs, either *hūratu* “madder” (*Rubia tinctorum*)

or ḥaṭḥuru or else *inzaḥurētu*.⁵⁴ In my opinion, the etymon of the term *urriqu* relates not to a blue dye but rather to the evanescent yellow-greenish colour of the wool when it is impregnated with an indigo-bearing dyestuff.⁵⁵ This colour is only a transient stage because the fibre quickly turns to turquoise and then deep-blue hues when it is exposed to light and air, as it returns to the greenish ones whenever the fibre is again dipped in the indigo-vat (Fig. 10.1).⁵⁶ BM 62788 records the *urriqu*-step also in the receipt for dye wool in *argamannu* colours, dipped in a solution with *kašû*, probably a direct dyestuff or, alternatively, with ḥaṭḥuru and alum.⁵⁷

The International correspondence of the Late Bronze Age records that *tabarru*-dye was a prestigious item exchanged as a diplomatic gift by the great courts of the Near East and the Mediterranean. Among the El-Amarna texts, the inventory EA 14 iii 27, 30, 32 lists *tabarru*-textiles among the gifts sent by Pharaoh Amenhotep IV to the king of Babylon Burna Buriash II.⁵⁸ In the letter RS XX 151 a lady from Ugarit sends TAB-*ar-ra* wool to her queen.⁵⁹ The attestation of *tabarru* besides dyestuffs designated as purple by the sequence “lapis lazuli” suggests that it might have been a very valuable quality of red wool, no less precious than purple wool.⁶⁰ In the Nuzi texts too, *tabarru* wool is distributed in various amounts (one or two mina) with *kinahhu*, *šurathu* and *takiltu* and it is listed together with *uqnātu*-wool and sorted wool.⁶¹

Textual contextualisation suggests therefore that this precious red colour was a particular shade among the reddish ones of the purple. In fact, if *tabarru* had been an ordinary red wool it would be moreover not possible to understand the use of *tabarru* as a gloss (SÍG.SA5 *tabari*) in a letter from Ugarit (RS XVII, 383, 32 ff.). In this missive, Takuhli(nu) of Ugarit delivered a gift of luxury cloths to the Egyptian governor in the Canaanite Aphek, a city also quoted in Egyptian Execration texts.⁶² The prestige of *tabarru*-wool might also be testified by the fact that it was delivered in a small quantity (10 shekels) compared to 100 shekels of SIG ZA.GIN “blue purple” wool.⁶³

Nonetheless, the terminology makes this identification a very complicated issue. Unlike *argamannu*, the word *tabarru* is not connoted as lapis lazuli and in lexical lists the sequence SÍG.ĤĖ.ME.DA is read both as *nabāsu* and *tabarru*.⁶⁴ Indeed, the logogram was translated as *nabāsu* “red-dye wool” until halfway through the 2nd millennium BC, when in Middle Babylonian texts the term *tabarru* appears.⁶⁵ Thus, it is possible that *nabāsu* and *tabarru* are not synonyms: probably the latter indicated a red dye obtained by exploiting a different natural source which was not available until the Late Bronze Age.⁶⁶ It is not too far-fetched to think that, before the acquisition of marine purple by ancient Near Eastern communities, the ideogram SÍG.ĤĖ.ME.DA experienced a semantic drift analogous to the logogram SÍG.ZA.GÌN(.NA), indicating the blue dyes obtained with vegetal indigoids. In fact, only in the period in which archaeological and epigraphic evidence testifies to the presence of purple dye in the ancient Near East, the signs SÍG.ĤĖ.ME.DA start to be read as *tabarru*.

According to these arguments, the first syllabic writing of *tabarru* might give a date for the early introduction of purple technology into the continental ancient Near East or, at least, for the first circulation of textile items dyed with marine purple. As a matter of fact, the highest frequency of the word occurs in the Late Bronze Age texts, when purple technology was already widespread in the continental Near East as testified to by the archaeological and epigraphical sources. Nonetheless, the reading *tabarru* is attested for the first time already at the end of the 18th century BC, in a few texts from the royal archives of the city of Mari, on the rivers of the Middle Euphrates Valley. Here, the knowledge of a sophisticated and flowery dyeing technology is testified to by the references to a workshop in which polychrome textiles (È bi-ir-mi) were manufactured.⁶⁷

In the letter ARM XVIII 11, the King of Mari Zimri-Lim ordered Mukannišum, the official in charge of the palatine textile production, to send him coloured *nahlapātum*-textiles.⁶⁸ Among these, were *tabarru* and *ḥašmānu* cloths: 200 red/red purple? (*ša dabarim*) garments, 100 sea-green/red purple? (*ša ḥašmānim*) garments, 100 white (BABBAR.MEŠ) garments, 100 black (GE6) and 100 apple-coloured (*širip ḥašhurim*) garments.⁶⁹ The term occurs in this text in its variant *ṭa-ba-r[u]*, */da-ba-r[u]*, but it is also present as *ta-ba-ru/tu-ba-ru* in a few texts from the same city, beside textiles, wool, dyes and mordants. Indeed, in the texts ARMT XXIII 145:3, 147:4, 148:3 alum is used to dye wraps of red wool.⁷⁰ Chemists know well that the dyeing process with colouring agents containing indigoids such as indigo, woad and marine purple does not require mordants.⁷¹ But, if *tabarru*-purple was actually adulterated with a mixture of other red dyestuffs such as madder or kermes, it shall be easier to justify the presence of alum or other mordants beside purple in the texts.⁷² Some 1st millennium tablets from Sippar record for example *tabarru ša inzaḥurēti* “red wool dyed with the *inzaḥurētu* dye”.⁷³ This attestation could be a reference of the adulterated or counterfeit purple dye obtained dyeing *urriqu* wool with the kermes.

The presence of *tabarru* dye in the Mari texts was noticed by O. Rouault, “un sens de ‘rouge pourpre’ lui avait été attribuée” and was successively discussed by J.-M. Durand, who considered the term a Hurrian loanword.⁷⁴ Syllabic writing of the term in the Mari texts is remarkable for several reasons. First of all, its early chronology (18th century BC) reopens the debate about the presence and circulation of marine purple in continental Near East already at the beginning of the 2nd millennium BC. Secondly, the recourse to the Hurrian terminology to designate a foreign imported technology from the Mediterranean is looks odd or at least unexpected. Finally, the ecological and cultural distance of Mari and the Euphrates Valley from the Mediterranean coast generates doubts regarding the natural origin of the dyestuff used to dye the wool in red purple colour.

As well as Nuzi (Yorghana Tepe, Iraq), the Hurrian city from which cuneiform

texts show the most abundant textual evidence for purple in the Late Bronze Age, the city of Mari (Tell Hariri, Syria), is rather far from the coast, namely the place where murex could be gathered and processed for purple. Indeed, Mari and Nuzi are both ecological contexts alien to the exploitation of marine resources: both territories are characterised by the abundance of pastures, flocks and wool. Moreover, both had at their disposal a social component that, combined the tribal and seminomadic structure – typical to the Amorrite and Hurrite pastoral societies – with the bureaucracy of the other state institutions, made them two of the most thriving centres of textile production and commerce. Beside the textile industry, their favourable position in the centre of the main exchange and communication networks of that time consented them to reach wealth and to accumulate the economic surplus indispensable in order to convert it to luxury and positional goods. These prestige items both were exhibited by opulent urban élites as status symbols and exchanged as diplomatic gifts in international relations and assimilated as a new technology in their own manufacturing system. Mari tablets might thus testify that purple was among the imported prestige goods in Syria already in the Middle Bronze Age, a period of widespread diffusion of the technology along the Eastern Mediterranean coast as testified to by archaeomalacological data.

A meticulous analysis of the triangle of commercial and technological contacts between the Old Syrian kingdom and the surrounding communities on one hand and the Minoans and Aegean peoples on the other (Fig. 10.2), could confirm the interpretation of this first attestation of the colour *tabarru* as early evidence for the use of marine purple in the ancient Near East.



Fig. 10.2. Mari and the Eastern Mediterranean during the Middle Bronze Age.

The Mari archives and the dawn of Internationalism

The international trade between Syro-Mesopotamian society and the communities inhabiting the coasts of the Eastern Mediterranean basin is a less well-known phenomenon for the Middle Bronze Age (Fig. 10.2) than the long-distance commerce of the Late Bronze Age.⁷⁵ For a long time historians and archaeologists specialized in the economy of the beginning of the 2nd millennium BC have often confined their investigations to the trade in rare metals, especially copper. On the contrary, the study of the cuneiform documentation shows that, from the Middle Bronze Age, wool and textile technology played a role comparable to metals in acting as a catalyst of the international trade.⁷⁶

Several texts from the Mari archives refer, for instance, to the fact that, in spite of the massive amount of textile production within the city, wool, textiles and garments were often purchased from far away.⁷⁷ Robes came from many different places in Mesopotamia but often from the Mediterranean seashores. Mari texts record textiles from Yamḥad (Akk. *yamḥādu*) and from Byblos (Akk. *gublāyu*) though it is not possible to ascertain from these *nisbes* whether the cloths were produced abroad and afterwards imported to Mari, rather than if the textiles were manufactured according to a local style.⁷⁸ Specific techniques and tools but also the recourse to different, unknown or typical local raw materials might make a difference among the final products, therefore contributing to the making of a proper fashion.⁷⁹ An Old Babylonian letter found in Hazor reports that the King of Mari required at least 20 different kinds of items of clothing from the city.⁸⁰ From certain letters we learn that King Zimri-Lim sent to Hammurabi of Babylon textiles (ARMT XXII 324, col. II, 8–9) and footwear (ARMT XXI 342: 5–6) as diplomatic gifts from the island of Crete (*kaptarum*, *kaptaritum*).⁸¹

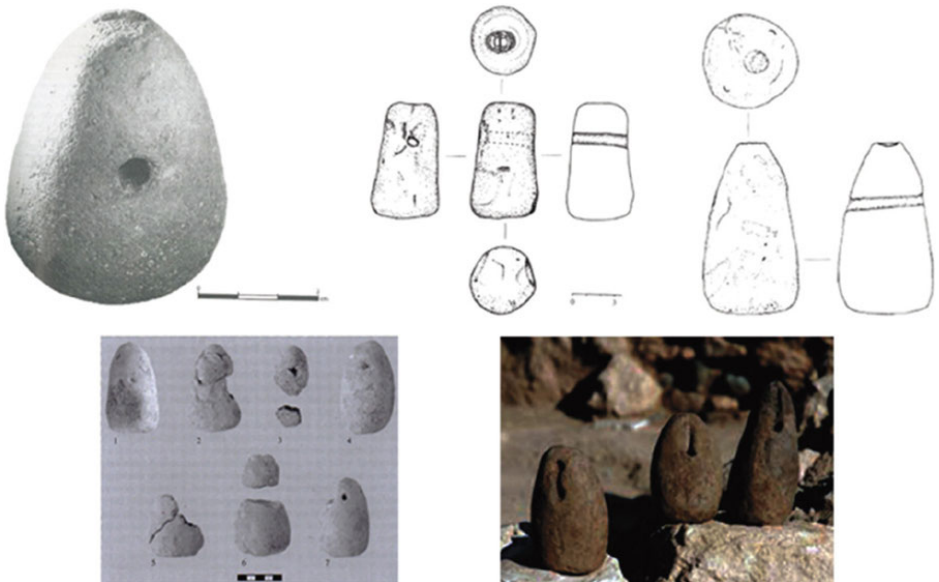


Fig. 10.3. MB II loom weights from Levant. Top, from left to right: loom weight with a scarab seal impression from Tel Nami (Marcus and Artzy 1995, 137, Fig. 1); loom weights with Hyksos and thumb-like impressions from Tell Taannek (Friend 1998, 34, Fig. 8 and 26, Fig. 6a). Bottom, from left to right: loom weights from the palace at Tel Kabri (Goshen et al. 2013, 49, Fig. 3.4); loom weights found in a metallurgic furnace (square I9, a) in Pyrgos Mavroraki, Cyprus (Belgiorno 2009, 72, Fig. 28).

Since Mari had a volume of textile production sufficient to satisfy internal demand as well as textiles from South Mesopotamia were profusely imported, what was so alluring with this “Mediterranean style”? Cuneiform documentation does not clarify the reason whereby Minoan robes enjoy such appreciation among the Syrian and Mesopotamian elites, although it is highly plausible that marine purple had played a leading role as a distinguishing mark of the Western textile industry. As B. Burke suggested in his brilliant work, the great *exploit* of the Minoan trade, more remarkable right at the beginning of the 2nd millennium BC, was due to the spread of purple dye products and to the transmission of the necessary “know-how” to produce them in the main commercial networks of the Eastern Mediterranean.⁸² The discovery of *Kamare*s ware in the Middle Bronze II archaeological levels at Aleppo, Byblos, Ugarit, Hazor, Qatna and in the island of Cyprus, shows that the greatest part of the commercial partner of Mari had cultural contacts with the Aegean civilization (Fig. 10.4).⁸³



Fig 10.4. Hazor and the Levant in the Middle Bronze Age: main cities quoted in the Mari texts (left) and southern Canaanite sites (right) where archaeological and textual evidence testify to contacts with Minoan and Cypriot textile technology.

Moreover, in addition to the Minoan pottery, a cone-shaped typology of clay-fired loom weights, well known in Anatolia and often linked to Cypriot materials, start to become common in the coastal South Canaanite sites (Fig. 10.3).⁸⁴ Since wool and textiles from these cities are quoted in Mari texts, the Mediterranean fashion may have been appreciated for its making use of some exotic western elements, including the warp-weighted loom and marine purple dye.⁸⁵ This hypothesis seems confirmed by the fact that the areas from which textiles and garments are imported will later become renowned centres of

production of purple and coloured cloths. In the middle of the 2nd millennium BC Hazor (Fig. 10.4) was famous for the refinements of its textiles as testified by a little tablet found in the Canaanite city and a text found in el-Amarna.⁸⁶ Archaeological excavations in the nearby sites of Tell Akko (13th century BC) and Tell Keisan (11th century BC) brought to light crushed murex middens and dibromindigo residues. At Tell Keisan a shell purple-dyed stripe was even found on the interior of a large vessel.⁸⁷ It is no coincidence that, during the 1st millennium BC, in the Bible Hazor is often linked to dyeing technology.⁸⁸

Moreover, at the site of Pyrgos-Mavroraki an actual industrial complex of the Middle Bronze Age was found. Its workshop was intended for the production of luxury goods such as perfumes and purple-dye cloth, with early evidence of the spinning of fibres already dyed with purple.⁸⁹ This discovery shows a different point of view about the trade between Cyprus and the Near East during the Middle Bronze Age (Fig. 10.4). Although in the Mari texts the island is quoted only with a reference to metals, purple-dye and the textile industry might already have been a prestigious and remunerative technology for import. Within the Levant, the purple industry of Cyprus was not only precocious but also long-lasting, since textual and archaeological evidence testify to its development during the whole of the 2nd and 1st millennia BC and beyond, until Late Antiquity.⁹⁰

Recently M. Vigo proposed that precious linen connoted in the Hittite inventory texts as “Cypriote” (GADA URU *Alašiya*) was instead produced from Egyptian flax and only subsequently brought to Cyprus to receive a special type of processing which transformed it into a luxury good.⁹¹ Archaeomalacological remains from the Late Bronze Age site of Hala Sultan Tekke (12th century BC) suggest that this special manufacturing was dyeing with marine purple. In the Old Testament (Ezekiel XXVII, 1–7), Alashiya (Heb. *‘iyyê(y) ‘ēlišāh*), the island of Cyprus is designated as the place of provenance of Phoenician purple.⁹² The text, dated to the beginning of the 6th century BC, is confirmed by archaeology, evidence for purple production in this period is attested at the Cypro-Archaic *Polis-Peristeries* sanctuary (Marion), on the north-western coast of the island.⁹³

Therefore, since the beginning of the 2nd millennium BC, purple-dye could have been known at Mari through its Amorite and Canaanite commercial partners living along the Mediterranean coast and the overseas trade with Crete, the Aegean lands and the island of Cyprus.⁹⁴ During the Middle Bronze Age, Aegean purple started to spread along the shores of the Eastern Mediterranean as testified to by crushed murex at Troy and in Cyprus. In the same period, epigraphic and archaeological sources confirm that the finished works, as cloths and finished products from Minoan and Cypriote workers, began to circulate in Levantine coastal cities beside metals and pottery. The Middle Bronze Age must be the period of the rising of what has been defined as the “Aegean/Syrian textile *koine*” (Fig. 10.4).⁹⁵ Consequently, the early occurrences of *tabarru*-textiles in the archives of Mari can reflect this new

cultural technological horizon.

Conclusions

The first attestation of *tabarru* coloured textiles is found in the texts of the royal archives of Mari, dating back to the end of the 18th century BC. Close relations between the Old Syrian kingdom and those Eastern Mediterranean cultures that were already familiar with purple technology, suggests that the term *tabarru* indicates a specific variety of the marine dye in use since the end of 2nd millennium BC. In the Middle Bronze Age, purple-dye might have been the catalyst of a strong economic network which trading textiles and metals, involved the Aegean, Anatolian, Cypriote, Egyptian and Syrian-Palestinian centres.⁹⁶

Nonetheless, the terminology of cuneiform texts is equivocal, since no difference is made between the colour of textiles and the dyes that produce it. Indeed, ambiguity is facilitated by the frequent recourse to figures of speech and to other linguistic expedients common in modern chromatic terminology; often colour terminology is linked with the name of plants, animals or minerals. Yet, beside the complexity to recognize the ancient phytonyms and zoonyms with the taxonomical species present at that time in the area, it is rather difficult to understand if these natural resources were actually used as raw materials in dye-making, rather than quoted only as terms of comparison.

The singling out of the raw materials used to produce these different colours is therefore a challenging issue, complicated in cuneiform texts by the fact that terms for colours are still uncertain. Moreover, 2nd millennium cuneiform texts do not explain the technical procedure used to obtain *tabarru* or the other nuances recognised by Assyriologists as varieties of purple; they do not specify natural resources used as raw materials to produce dyes and obtain specific hues of colour. Indeed, philologists have often tried to find a term for murex in cuneiform texts but with limited results.⁹⁷

Only Ugaritic literary texts were able to provide Semitic terminology for the molluscs; in the *Baal Cycle* (1.3 II, 2–3; III 1–2; IV 45–46) the goddess Anat beautifies herself with the purple of the murex “whose secretions cover a thousand acres in the sea”: *tpp. 'anhbm. d'alp.šd/z'u [h.bym]*.⁹⁸ In the *Aqhat Epic* (1.19 IV 42–43), Pagat *t'ad t'id(!)m bglp y[m]*, “reddled herself red with the shell (?) of the se[a]”.⁹⁹ According to S. Ribichini and P. Xella (1985), who edited a monograph on textile terminology in Ugarit, *anhb* and *g'lp* refer to the name of the two species of gasteropods from which purple is extracted.¹⁰⁰ The word *'anhbm* (*'anhibīma*) “murex” is linked with Akkadian *yānibu*, *nibu* “stone, shell” and with Arabic *nahaba* “to plunder, take booty”.¹⁰¹

A cuneiform text reports x MA.NA *ḫuruḫurātu ša ta-bar-ri-be* “10 minae of deep red of the *tabarru* kind”.¹⁰² Yet in another text from the same archives (AASOR XVI 77, 13) *ḫurḫurāti ša tūlti* is translated as “red dye extracted from

maggots, kermes”.¹⁰³ It is possible that in the former text a genitive form of *tabarru* is used to specify the natural source used to obtain *ḥuruḥurātu*-dye and not only as a gloss. In the above-mentioned text from Ugarit XVII, 383, 32 there is a similar use of the genitive: SÍG.SA5 *tabari*. If *tabarru* is a concrete and physical matter and not only a colour, could its name be connected with the sea, murex shells or with some step or technique linked to the production cycle of purple-dye?

The etymology of *tabarru* has not been investigated because the word is not considered Semitic by the greater part of Assyriologists.¹⁰⁴ The wide number of attestations of the term in the text from Nuzi and in the Middle Assyrian letters contributed to considering this term as a loanword from Hurrian.¹⁰⁵ J.-M. Durand argued that fluctuations *ta/da/tu* of the initial in the texts of Mari depends on the extra Semitic origin of the word: *tabarru* shall be an Akkadization of an original word **tabaru*. Its late form *tabarru* shall be the result of the assimilation of the Hurrian article according to the process **tabar-ni > tabarri*.¹⁰⁶ In fact, **tabaru* could not subsist otherwise; indeed, in Akkadian writing, two short syllables cannot follow one another in the same word.

Nevertheless, recently in his Hurrian glossary, T. Richter asserted that *tabarru* is an original Akkadian term, subsequently borrowed by the Hurrian language.¹⁰⁷ Therefore, it would be possible to investigate Semitic etymology and to discuss the proposed form **tabaru*. Could the syllabic writing *ta-ba-ru* be read alternately as *tabarru* and **tabāru* in accordance with the behaviour of the noun *na-ba-su*, attested as both *nabassu* and *nabāsu*? The word **tabāru* could be linked to a possible *taprās* form of the Akkadian *ba'āru/bāru* ‘to fish, to catch’. The verb is used not only in hunting but also in military contexts: two meanings are related by the common use of a net or cage (*nabāru*), perhaps in the case of fishing a fish trap. This shall tally with what has been said by Classical sources about murex gathering and with the above-mentioned semantic link of the Ugaritic *'anhbm* with the Arabic *nahaba*. Unfortunately, the *taprās* form of the Akkadian *bāru* is never attested and while some texts report the syllabic writing *na-ba-as-si*, the proposed form **tabāru* is not backed up by textual evidence. At least for the moment, terminological investigation allows us to consider the term *tabarru* simply the denomination of a coloured textile.

Therefore, the historical, technological and economic background of the age of Mari texts allow us to believe that an early spread of purple-dye technology in the ancient Near East occurred already in the early of the 2nd millennium BC. In light of the current state of knowledge, it looks plausible that, thanks to the intense trade relations with the islands of Eastern Mediterranean Sea, the inhabitants of Syria and Palestine knew and appreciated Minoan and Cypriote cloths and started to acquire from them some elements of the Western textile technology. Nevertheless, it is not clear either whether *tabarru* was a particular hue of purple obtained by mixing genuine molluscan purple with other dyestuffs, rather than a forgery produced only from other natural resources. In

both cases, these early attestations of *tabarru*-wool suggest that Syrian and Mesopotamian people, fascinated by the exotic colours of the garments worn by the strangers they were trading for copper and tin, started to elaborate techniques to imitate them by using the natural resources they have at their disposal. Nevertheless, only future archaeological discoveries will provide confirmation of the direct exploitation of murex snails or at least evidences of the circulation of marine purple in Syria since the beginning of the 2nd millennium BC.

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Abbreviations

AASOR	The Annual of the American Schools of Oriental Research
AbB	Altbabylonische Briefe in Umschrift und Übersetzung
AHw	W. von Soden, <i>Akkadisches Handwörterbuch</i> , Wiesbaden 1958–1981
ARM	Archives royales de Mari
ARMT	Archives royales de Mari (Transcription, traduction, commentaire), Paris
BAR	British Archaeological Report
CAD	The Assyrian Dictionary of the Oriental Institute of the University of

EA	Chicago, Chicago 1956 Text from el-Amarna, according to J. A. Knudtzon, <i>Die El-Amarna-Tafeln</i> , Vorderasiatische Bibliothek 2, Leipzig 1915
IBoT	Istanbul Arkeolji Müzelerinde Bulunan Boğazköy Tableteri, Istanbul
KBo	Keilschrifturkunden der Vorderasiatisch-ägyptischen Gesellschaft, Leipzig
MARI	Mari, <i>Annales de Recherches interdisciplinaires</i>
MSL	Materialien zum sumerischen Lexikon/Materials for the Sumerian Lexicon, Rome 1937
NABU	Nouvelles Assyriologiques Brèves et Utilitaires, Paris 1987 ff.

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1According the Old Testament (Genesis X, 19) the territory of the Canaanites extended from Sidon as far as Gaza.

2Exodus XXV, 4–5; XXVI, 1; XXXVI, 35; 2Chronicles II, 6; Ezekiel XXIII, 4–7. See Zaccagnini 1973, 175.

3Exodus XXV, 4–5 XXVI, 1; XXXVI, 35; 2Chronicles II, 6.

42Chronicles II, 6; Exodus XXXV, 35; XXXVIII, 23; Judges V, 30.

5Il . VI, 288–292, where Hecuba selects from various cloths one to offer to thena and Odyssey XV, 399–401 where Eumaeus, the Odysseus’s swineherd, tells his own kidnapping and sale thanks to the complicity of his Phoenician nurse. Note that in Homer and the Bible (Judges X, 12) Sidon stands for Phoenicia in general and all inhabitants of Phoenicia were equally called Sidonians.

6Hor., *Ep* . I, 10, 26–29; Str., *Geog* . XVI, 2, 23.

7Poll., *Onom* . I, 45.

8Str., *Geog* . XVI 2, 23; Hor., *Epod* . XII, 21: *muricius Tyriis iteratae vellera lanae* ;

Ov., *Met.* VI, 61–62 e 221–223, *Plin.*, *HN* IX, 124–141.

9Tadmor 1994, 69–70.

10 Speiser 1936; Albright 1942; 1961; Maisler 1946, 7–12; Cf. Astour 1965.

11 See Albright 1942; *contra* Moscati 1959.

12 *Stramonita* is not properly a murex since it belongs to the Family Thaidae. Another species within the same family able to produce purple-dye: the use of the Indo-Pacific *Thais savignyi* for dye have been noted for the archaeological sites of Haft Tepe in Iran and Khor Ile-Sud in Qatar, see Reese in this volume, Edens 1999 and Singer 2008, 24. Outside the Mediterranean world, other marine gastropod mollusc can also produce a similar substance: *Plicopurpura pansa* from the eastern Pacific, *Plicopurpura patula* from the Caribbean Sea and *Nucella lapillus* from the North Atlantic. See Michel and McGovern 1990.

13 Reese 1980, 81–82; Karali 1999; 2005; Ruscillo 2005; Carannante 2014.

14 For a recent synthesis about archaeomalacological data, see Karali 2005; Alberti 2006; Carannante 2014.

15 Reese 2010, 124.

16 Lentini 2009, 153–171.

17 Reese 2010, 120.

18 James *et al.* 2009; Baccelli 2012.

19 Reese 2010, 118–119; Karali 1999, 44; 2005.

20 According to the Bible, this is the territory where the tribes of Judah and Dan lived. The artisans Betsaleel and Oholiab came from here. Their skills in manufacturing blue purple, red purple, kermes and byssus, were requested in Israel, Exodus XXXV, 30–35; in Judges V, 30, Sisera's mother soliloquy concerns also dyestuffs and coloured textiles.

21 Reese 1985; 2010, 125.

22 See Astour 1965.

23 The colours *phoînix* and *phoinos* were originally linked with the term *phonos* “murder”. But Astour (1965) proved that this term cannot be related to the Myceanen colour *po-ni-ki-jo*. Nevertheless, both the names of the dyestuff and of the people who trade in it, could perhaps be related to the ancient phytonym of the date-palm tree (Gr. *phoinix*), unfailing plant in the Levantine shores. The colour of its fruits (Gr. *phoinikion*), when fresh, is crimson. See Soriga 2013.

24 Astour 1965, 349, n. 31; Murray and Warren 1976; Barber 1991, 232 n. 11, Nosch 2004; Soriga 2013.

25 Del Freo, Nosch and Rougemont 2010.

26 Also Boesken in this volume. Mesopotamian dyeing procedures do not appear so much different from those recorded in the Classical sources: from the half of the 2nd millennium BC, the Middle Assyrian and the Ugaritic texts used the causative form of the Akkadian verb *bašālu* “to boil, to keep boiling” (CAD

B, 135) to mean “to dye” as well as his derivative adjective *bašlu* (CAD B, 140) “cooked, boiled” as a noun denoting the dyed fabric. See Bottéro 1957, 276. Thanks to P. Abrahami, scientific communication, SHAMO 2014, *Maison Archéologie et Ethnologie, René-Ginouvès*, Nanterre, 13 March 2014. Experimental archaeological texts proved however that at the boiling temperature the colouring agent of the dyestuff decays, see Ruscillo 2005.

27 Koren 2013; Ruscillo 2005; Longo 1998, 86. Homer’s metaphor of the *porphurea thalassa* “purple sea” probably refers to the dark colour of the rough sea, that seething of foam, reminiscent of the chemical processing in the making of the dye. Pliny, *HN* XXXV, 46 mentions *purpurae spuma* “purple foam”, used in order to produce a “forgery of the indigo”.

28 Moscati 1959; Ezekiel XVI, 29 and I XVII, 4; Zephaniah I, 11. See also Lemche 1991, 25–28.

29 Already in ancient times the place name was derived from an eponymous mythical ancestor. Astour 1965, 347 reports the name of Chna as mythical ancestor of the Phoenicians. More recently, an etymology in accordance with the meaning of the Semitic root *knʿ* “to be subdued” likely referred to the morphology of the Levantine landscape has been proposed. Killebrew 2005, 139, n. 3.

30 Nonetheless, other theories argue that the difference in colour could depend on the exposure to the solar light besides sexual dimorphism Longo 1998. See also Barber 1991, 229–230; Fales 1998; Haubrichs 2004; Koren 2013; Singer 2008, 23.

31 About chemical interactions of some matters quoted besides the name of purple and other dyestuffs in cuneiform documentation, I’m currently carrying out some tests in the Istituto di Chimica Biomolecolare of CNR, at Pozzuoli, Napoli. Thanks to Maria Letizia Ciavatta and Pietro Amodeo for their assistance and enthusiasm.

32 See Leichty 1979; Michel and McGovern 1990; Cardon 1999; Finkel *et al.* 1999. These dyestuffs could be used in falsification practices, in order to create a forgery without using expensive marine purple. More usually, cheap and precious substitutes were employed in processes of adulteration, in combination with a little quantity of genuine purple, eventually too concentrated or shoddy, in order to upgrade their quality or, eventually, to create new and original shades. The wide terminology used in the texts may reflect such different shade varieties.

33 Landsberger 1967, 147–149.

34 See Cassin 1968, 115–116. Other kinds of SÍG.ZA.GÌN colours in Ugarit texts are *ḥandalatu*, *ḥasertu* and *dupašši*, van Soldt 1990, 344; Singer 2008, 34, n. 33.

35 Literally the colour of the “glowing charcoal” and interpreted as a dark kind

of red purple rather than a blue-green dye as indicated by the Akkadian corresponding *ḥašmānu* (CAD H, 142; AHw 334b) cf. Goetze 1956, 35; Singer 2008, 23; van Soldt 1990, 334.

36 Singer 2008.

37 Singer 2008, 34, n. 35 e n. 36: he translates it like “red purple”; *contra* CAD H 142 e AHw 334b that translate *ḥašmānu* as “blue-green” and “*bläulich*” respectively.

38 2Chronicles, 13–14; Ezekiel, XXVII, 7. The correspondant colours are named in Latin *pelagia* and *purpura*, see Singer 2008.

39 The designation “cloth of lapis lazuli-colour” appears in an Old Assyrian text (Kt 93/k 779, 8': 2 TÚG ḥu-sà-ru-um) where na4 za-gìn “lapis lazuli” is read *ḥusārum*, Michel 2001, 344, n. 19. There is also the occurrence, even if isolated, of SÍG *uqniāti ta-ak-la-tim* in an Old Babylonian letter, cf. Singer 2008, 34, n. 30, who nevertheless states: “it’s very unlikely that these (two Middle Bronze Age texts) should refer to a purple-dyed fabric”. For the quotes of the term in the 3rd millennium BC, cf. Biggs 1966, 175.

40 Biggs 1966; Singer 2008; Cardon 1999.

41 CAD U 194–195, sub *uqnātu* and *uqnû*; CAD Q 305, sub *qunātu* and 307 sub *qunû*; Landsberger 1967, 164 and 167; Oppenheim 1967; Fales 1998, 827, note 7; Finkel & Granger-Taylor in press. Nevertheless, according to F. Brunello (1968, 69), there were several other endemic plants with high contents of indigoids: *Polygonum tinctorium*, *Marsdenia tinctoria*, *Strobilanthes flaccidifolius*. Among indigo-bearing plants, *Indigofera tinctoria*, from which indigo is extracted, was traditionally for its Indian origin. Nevertheless, according to A. Lentini (2009, 169) several species of *Indigofera* (*I. tinctoria*, *I. argentea*, *I. spinosa* and *I. semitrijuga*), today endemic in Egypt and Sudan, were original plants from Near Eastern lands, Lentini 2009, 169. Recent excavations in the Palestinian area confirmed the use of *Indigofera* spp. since the end of the 2nd millennium BC, see Peyronel 2004, 74, n. 97.

42 Landsberger 1967, 147–149; Singer 2008, 23.

43 Cassin 1968, 115–116 maintains that red and blue purple cloths shared the quality of shininess and iridescence (Akk. *namru*) and that this feature was more remarkable for the ancients than the exact chromatic division (blue-violet or red) appreciated by modern scholars.

44 Landsberger 1967, 155; CAD A/II 253, sub *argamannu* “red purple wool” and “tribute”. In BM 62788 the *argamannu*-wool is written as sīg SAG “wool for the chief” where the sign saĝ has the meaning “head, chief, master”.

45 Landsberger 1967.

46 In agreement with B. Landsberger, I. Singer (2008) excludes the terms *kinahḫu* and *tabarru*: “... it may summarily be concluded that only the terms *argamannu*, *ḥašmānu* and *takiltu* are related to the purple-dye industry, whereas

other designations for reddish and bluish shades have probably nothing to do with the dye produced from the marine snails”. He supports instead that *ḥašmānu* is a reddish and not a bluish colour and correlates it to marine purple.

47 AHw , 1298; CAD T 21, sub *tabarru* . Sometimes this logographic writing can be read as *tabribu* (SÍG.ḤÉ.ME.DA, TÚG.BAD) “a red dyed wool/cloth”, considered a genitival Akkadised form of the Hurrite *tabari-we* in Durand 1984, 428–429; Abrahams 2014, 294: “ *tabarru* (*tawarriwe*) corresponds to a red-dyed wool”; Postgate 2014, 410 does not consider it purple since “the logogram (síg-)ḥè-me-da is not composed with the element za-gìn, and the best attested dyeing substance in Assyria, which is ‘madder’ is unequivocally a plant (not from shells)”.

48 Maisler 1946, 7–12; Astour 1965, 346–350, note 31: “ ... *tabarru* , the comprehensive Akkadian term for ‘purple, scarlet’ (probably a loan-word?)”; Reallexikon der Assyriologie Bd 3 Cpit Ae Geb, sub Färberstoffe, 27: “ *tabarru* (Nuzi: *tawarwa*) ‘ hell pupurn ’”; Durand 1983, 428, n. 1. “ *pourpre* ” but see also for a different and more recent translation Durand 2009, 120–121.

49 Goetze 1956, 35; Oppenheim 1967: *tabarru ša ḥūrati* ; Barber 1991, 230; Matoian and Vita 2014, 139 translate *tabarru* (alph. *šmt* ; síg-hé-me-da/ta, sígsa5) as “carnelian red/red-brown purple”.

50 The chromatic result of this process was a purple *nigricans aspectu idemque suspectu refulgens* «black and yet rich in changing tints» as clotted blood, Pliny, HN IX, 124–141.

51 Exodus XXXV, 23; XXXVI, 8; XXXIX 2, 8 and 28.

52 See n. 32.

53 Leichty 1979; Finkel *et al* . 1999.

54 Finkel *et al* . 1999, 65 translate *urriqu* as “bleu moins foncé” because “obtenu par seulement trois trempages successifs dans une seule cuve”. The *urriqu* (CAD U 242–243) is also a name of a yellow-greenish stone; it is related with the causative form of the verb *arāqu* “to cause to be green; to turn yellow” (CAD A 231) and with *urqu* (Ú.SAR) “vegetables”. See Michel and McGovern 1990.

55 The *urriqu* (CAD U 242–243) is also a name of a yellow-greenish stone; it is related with the causative form of the verb *arāqu* “to cause to be green; to turn yellow” (CAD A 231), with the noun *arqu* (Ú.SAR) “vegetables” and the adjective *urqu/arqu* (SIG7) ‘yellow-green’ (CAD A 300–302 and U 239–240).

56 Laboratory tests undertaken at the Istituto di Chimica Biomolecolare, CNR of Pozzuoli, Napoli. See also Koren 2013.

57 The *ḥaṭhuru* and *inzaḥurētu* are interpreted as dyestuffs able to bestow red colour to the wool because their relation with *ḥūrati* “madder”. The *ḥat ḥuru* -dyewas used also to produce the *ḥaš ḥūru* -dye “apple colour”, a red hue or a green hue, see Payne 2007, 134–136 and tab. 4.8. The term *inza ḥurētu* has

been interpreted as a synonym for *ḫurḫurātu* “crimson, scarlet, vermilion”, the colour obtained from the insects, van Soldt 1990, 346; Payne 2008, 187–188. In Nuzi texts the occurrence of *ḫurḫurat[u] ša tūlti* ‘red extracted by insects, worms’ indicates unequivocally the exploiting of kermes maggots since the middle of the 2nd millennium BC, see Fales 1998; Soriga 2013. In the 1st and 2nd millennia BC Near Ancient East, dried maggots of cochineals come from the Mediterranean shores where larvae of *Kermes vermilio* live, feeding on oaks moisture and nutrients. In ancient texts (Barber 1991, 231) nevertheless Armenia and Central Asia are often linked with kermes and crimson production. Therefore, most likely in Eastern Mesopotamia dyers used maggots of *kirmiz* (*Porphyrophora hamelii*), the Armenian cochineal. See Donbaz 1988.

58 Moran 1992, 32.

59 Zaccagnini 1973, 181.

60 Textiles coloured in *sūntu* (SÍG.ZA.GÌN.SA 5) for *argamannu*, *ṣalittu* (SÍG.ZA.GÌN.MI), *inzurātu* (SÍG.ZA.GÌN.NA).

61 Abrahams 2014.

62 RS XVII, 383 = PRU IV, 223; Singer 2008: Huehnergard 1987, 206.

63 Singer 1983, 6–18.

64 SÍG.ḪÉ.ME.DA = na-ba-su, ta-LU-ri (mistake for *tabarri*) in Hh. XIX 78–78a; [SÍG.ḪÉ.ME.DA] = na-ba-su = *dar-* [x], *ta-bar-* [ru] Hg. C II 3f., in MSL 10 139; TÚG.BAD, [*tab*]- *ri-mu* = *ta-bar-ra* -[x] (preceduto dai sinonimi di *uqnātu*) Malku VI 185f.

65 CAD NI, sub *nabāsu* , 22: “From MB on, the log. *síg* HÉ.ME.DA has the reading *tabarru* ”; AHW 697, sub *nabašu* “ *rote Wolle* ” *síg* gan-me-da = *na-ba-su* (= *ṭár-* [ru], *ta-bar-* [ru] MSL 8/2, 170, 1. But in AHW sub *tabarru* 4, this conclusion is less sure, cf. Landsberger 1967, 162; Fleming 1992, 172.

66 *Contra* Zawadzki 2006, 114, n. 340 reports that in BM 61504:10 *tabarru* is replaced by *nabāsu* .

67 Joannès 1984, 149–170.

68 Regarding to the *naḥlaptu* -garment see Michel and Veenhof 2010, 226–228; Zawadzki 2006, 114–117.

69 Rouault 1977, 31; Joannès 1984, 153, n. 45; cf. CAD H 142, sub *ḫašmānu* : “a blue-green colour” with reference to the wool; CAD H 140, sub *ḫašḫūru*, “ = *urtū* , apple-coloured wool, probably green or yellow”; see also *ḫenzūru* (Syr. *ḫazūrā* “apple”) coloured wool in the Nuzi texts, in association with *tabarru* and *kinahḫu* red wool, CAD H 170, sub *ḫenzūru* .

70 Joannès 1984, 160–162.

71 R. Haubrich and P. Amodeo personal communications; cf. also Peyronel 2006.

72 In the texts from Ugarit the *qnum* (*qannā’ūma*) were “experts in purple

work”, see Matoïan and Vita 2014, 319: “the only mordant clearly attested to in Ugaritic texts is alum (alph. abn šrp; syll. na4 ka-bi, na4 *gabû*); documents reveal that it was abundantly traded”, Matoïan and Vita 2014, 319.

73 Zawadzki 2006, 125.

74 Rouault 1977, 31; Durand 1983, 428–429; 2009, 120–121.

75 Wiener 1987; Larsen 1987; Heltzer 1989; Astour 1995; Ilan 1995; Joannès 1996; Michel 1996; Burke 1999; Durand 1999; Maier 2000; Charpin and Ziegler 2003; Ziegler and Charpin 2004; van Koppen 2007. For the international trade in the Late Bronze Age, see Zaccagnini 1973.

76 Wiener 1987; Malamat 1998, 39; Burke 1999; Goshen et al. 2013.

77 Malamat 1998, 38; Michel 2014.

78 Bottéro 1957, 126–127: textiles from Karkemish (MU.DU *Ap-la-ḥa-an-da*) and Yamḥad are recorded beside typical Mediterranean product as wine, honey and olive oil in the tablet ARMT VII, 238; Malamat 1998, 37–38.

79 Malamat 1998, 38; Vigo 2010, 291, 296 note 18 for Hittite *Inventory Texts* in Late Bronze Age; for the western exotic fashion of *lubulti birme u kitê* “multicoloured linen clothing”, see Oppenheim 1967.

80 Horowitz and Wasserman 2000; 2004, 344; Ziegler and Charpin 2004; Horowitz et al. 2006, 83–85.

81 Villard 1984, 528–529, num. 556: 28; Malamat 1998, 38; Cline 1994, 126–128; Guichard 1999.

82 Burke 1999.

83 Betancourt 1998; Minoan pottery has not been found in Mari but it is quoted in the Mari texts (ARMT XXV8, 3; 10, 6; 45, 2 e 4; 499, 21; 511, 8; 515, 8; 523, 12; 526, 4; 530, 2), cf. Malamat 1998, 38. In Egypt and at Ugarit several local imitations of Kamares Ware are known, cf. Wiener 1987; cf. Aubet 2013, 251 for Byblos.

84 This typology of weights is typical in Anatolia since the half of the 3rd millennium BC: it is in Troy II, Aphrodisia, Alaca Höyük, Alishar, Mersin, see Peyronel 2004, 207–208; Cheval 2008; Barber (1991, 301). Pyriform-shaped loom weights were found in the Middle Bronze Age II levels at Tel Taannek, Tel Nami and Tel Kabri (modern Israel) and Pyrgos-Mavroraki (Cyprus). Marcus and Artzy 1995; Friend 1998, 33–34; Goshen et al. 2013; Belgiorino 2009, 68, 71–72.

85 Friend 1998, 8: “As mentioned earlier, the traditional date for the introduction of the warp-weighted loom in the Levant is the Middle Bronze Age period”. Perhaps it is no coincidence that Aegean-type frescoes in the Levant were found in the Middle Bronze palaces of Qatna, Tel Kabri and Alalakh (Feldman 2007). In Qatna (Tell Mishrife, along the Middle Orontes River in Syria), archaeologists found the most ancient purple remains of the continental Near East. In the late 18th century BC, diplomatic and economic exchanges

with Mari were encouraged through a cunning matrimonial policy between the royal courts. During the earlier 2nd millennium BC, Alalakh (Tell Atchana in the Amuq plain in present-day Turkey) was an important city belonging to the kingdom of Yamḥad, centered in Halab (Aleppo). It is not known if the exotic *yamḥādu* garments were imported in Mari from Halab rather than from Alalakh, but Šibtu, queen of Mari and “wife as deputy” of Zimri-Lim come from the territory of Yamḥad. Tel Kabri, sited along the coast of the northern Akko valley in Upper Galilee, served as primary link between Hazor inland and the coastal routes, showing strong ties to the island of Cyprus too.

86 EA 22, 41, Moran 1992, 53.

87 Reese 2010, 121.

88 See note 20.

89 This procedure (*top dyeing*) is still well illustrated by Homer (*Od* . IV, 133–136): sitting in front of Telemachus and Menelaus, Helen wields a golden distaff full of staples of ἰοδνεφές ‘violet’ wool in order to spin them.

90 *Vita Aureliani* XII, 1; *Vit. Claud* . XIV, 10; The discovery of purple-dye fabrics in Enkomi (1st century BC–1st century AD) strengthens coeval textual references; still in the 6th century AD, Isidore of Seville quoted the Cypriote purple as one of the best in antiquity, confirming the longevity of this technology.

91 KBo XVIII 175, obv.col. I 5; IBoT I 31; EA 33–40; Vigo 2010; Cf. also Goetze 1956; Singer 2008.

92 S. Moscati (1966, 108–110) studied this biblical passage towards the Phoenician commerce. Recently, the text was interpreted by M. Liverani (1991) as a grandiose description of the Phoenician trade of the 7th–6th centuries BC. See Vigo 2010. I. Herzog (1987, 41) has already pointed out the role of purple producer for the island of Cyprus.

93 As in the coastal site of Kommos, in Crete, here the production of purple-dye was associated to a shrine too, Reese 2000; Reese 2010, 125; see also the contribution of D. Reese in this volume.

94 See Altman 1996 and Astour 1995.

95 Barber 1991, 311–357.

96 In 19th century BC Anatolia, the Old Assyrian merchants of the *karum* of Kaneš bought silver and gold exchanging wool and tin, see Michel and Veenhof 2010, 214; Larsen 1987.

97 Albright 1961; Astour 1965; Fales 1998.

98 Smith and Pitard 2009, 145; Ribichini and Xella 1985, 23.

99 Smith and Pitard 2009, 216.

100 Ribichini and Xella 1985, 22. In antiquity the diverse quality of the molluscs was well-known: according to the Aristotelian taxonomy, the

gastropods are named *purpura* (*Hexaplex trunculus*) and *murex* (*Bolinus brandaris*). The blue purple shall be secreted only from *Hexaplex trunculus* whilst the red purple from *Bolinus brandaris* . A deeper hue of red purple was obtained instead from snails that live in coastal rocks, probably *Stramonita haemastoma* .

101 CAD I/ J 322, sub *janibu* ; Smith and Pitard 2009, 145 ascribe the semantic connection between these Semitic words to the voracious nature of the murex snails, known to be among the most ferocious predators, at least among the gastropods.

102 Donbaz 1988, 70.

103 Fales 1998; Abrahams 2014, 293.

104 Durand 1984, 428, note 1: “Tout indique dans ce vocable (structure, absence d’étymologie) une origine extrasémitique. Je proposerai donc de comprendre que le tabarrum (récent) représente l’akkadisation d’un terme hourrite pourvu de son article”; Durand 2009, 120, a) “emprunt par l’akkadien d’un terme hourrite”;

105 Goetze 1956, 34–35: “ *tawarri* clearly a Hurrian word, is the source of Akk. *tabarru* ‘red dye, red purple’”.

106 The word * *tabaru* should be confirmed by the writing *gú ta-ba-ru* in M.5681, iii 29, a text that quotes commodities from the Qabra region “où une forte implantation hourrite peut être supposée”, Durand 2009, 121.

107 Richter 2012, 440–441.

The spread of purple dyeing in the Eastern Mediterranean – a transfer of technological knowledge?

Christoph Kremer

Introduction

Shellfish purple is certainly one of the most enigmatic dyes of the past. The shades of purple, red and blue one can create with it have fascinated both ancient historians and modern researchers. Due to the rather small amount of colourant you can obtain from the hypobranchial gland of one mollusc, textiles dyed with this colour were highly valued. Its combination of vibrant hue and high cost makes it one of the most ideologically charged colours of the past. Already in the earliest written accounts on purple-coloured textiles they are described as a tribute to the Hittite king and other Near Eastern rulers.¹ In the Greek and Roman world it was one of the main means of self-representation for rulers and other members of the elite, which were exclusively dressed in it.² Even today purple-dyed textiles have not lost their appeal and are associated with a special symbolism. Purple-dyed neckties, for example have gained a certain popularity among politicians, as the former British Prime Ministers Gordon Brown and David Cameron bear witness to.³

Although we are quite well informed about the trade and symbolic roles purple-dyed garments had in different societies, our knowledge from archaeological sources on the other hand is still limited in various accounts. This situation has been tackled from different angles by new research, such as experimental archaeology⁴ or new archaeological finds of actual workshop areas such as on Chryssi Island,⁵ and the workshop of Pefka-Alatzomouri, Crete.⁶ What is clear from the archaeological evidence so far is that purple dyeing originated on Crete. Systematic documentation of murex shell heaps – our most reliable indicator for purple dyeing – around the Mediterranean provided more sufficient and precise data to re-evaluate the question of the origin of purple dye and its spread.⁷ It had an important role in the Cretan economy and trade of the 2nd millennium BC⁸ and should be more embedded in the economic developments taking place from the middle of the 2nd millennium BC onwards. During the MM IB period, the first balance weights are found on the island.⁹ This innovation fundamentally changed and formalised economic interaction. Since the standard of the weights found on Crete utilised

the Near Eastern one,¹⁰ an intensified trade with this region can be derived. This intensification is further corroborated by the growing number of Near Eastern objects found on Crete and Cretan artefacts found in the Near East during the EM III and early MM period.¹¹ It is in this context that the innovations and changes in textile production – most notably the invention of purple dyeing – must be seen.

More and more evidence points to Crete as the cradle of purple dyeing in the ancient Mediterranean, however, the spread of this technology in the Eastern Mediterranean is still a research deficit. This situation is partly due to the fragmentation of the research, where purple dyeing is studied isolated from other parts of textile production and from other economic events of the Bronze Age. Thus, it would be interesting to link the spread of purple dyeing to other innovations during this period in order to address the different ways purple-dye technology has spread throughout the Eastern Mediterranean. The idea how this technology was diffused is more or less undefined. On the other hand, for the beginning of purple dyeing on the Levantine coast the discussion has already taken into account an introduction from the Aegean.¹² The goal of this paper is therefore to start a discussion on different ways we can address the spread of purple dyeing in the Bronze Age Eastern Mediterranean. To achieve this, purple dye production will be contextualised in the textile production of the 2nd millennium BC.

Shell purple dyeing on Crete and in the Aegean

Actual purple-dyed textiles are rarely known from the Bronze Age Mediterranean. This is mainly due to the specific preservation conditions of textiles and dyes. In fact there is only one textile, which has been found in the royal tombs under the Palace of Qatna in Syria.¹³ The precise date of this purple-dyed textile is difficult to assess, as the tomb had been used for several hundred years.¹⁴ The burial chamber itself was built during the Middle Bronze Age II (17th century BC).¹⁵ Most of the small finds of the last burial are, however, much younger and date to the Late Bronze Age, prior to the destruction of the palace around 1340 BC.¹⁶ Therefore the textile can be dated roughly to the late 15th or 14th century BC.

Due to the lack of textiles and trustworthy interpretations of dyeing installations we need to look at other less direct sources to trace the distribution of purple dye in the Eastern Mediterranean. For this heaps of crushed murex shells are still our best indicator. Archaeomalacological studies of the last decades have dramatically enriched our understanding of the chrono-spatial distribution of purple dye,¹⁷ as well as taphonomical issues, such as the secondary use of the shell waste.¹⁸ This has refined our ability to identify production of purple. However, the presence alone of murex does not prove the production of shellfish purple dye. Shells of the murex family are already known from various sites of the Aegean such as Neolithic Knossos,¹⁹ Aceramic

Neolithic Khirokitia, Cyprus,²⁰ from the Neolithic period onward. Also the evidence from the Early Bronze Age, such as the Early Helladic, Färberhaus' at Ägina-Kolonna²¹ should be considered as food waste rather than evidence for dyeing, as the shells were found intact.²² In fact, it is not until the early second millennium BC that we find the first real evidence for purple dyeing in the Mediterranean. The oldest purple-dye production to date has been found on Crete, in Middle Minoan contexts on the island of Kouphonisi.²³ The Cretan origin of this technique is furthermore strengthened by the sheer number of sites with evidence of purple dyeing on the island dating to the MM (Fig. 11.1).

In the course of the Middle Minoan period the number of known sites with remains of crushed murex shells increased, especially on the eastern part of the island, as at Petras,²⁴ Palaikastro²⁵ and Karoumes.²⁶ During the Late Minoan period a decline in the production of purple dye seems to occur – at least from what can be deduced from the murex shells – as it is only attested to at Chania-Kastelli House I, Room F,²⁷ Makrygialos. LM IIIB Palaikastro is the latest known purple-dye evidence for the Bronze Age on Crete. In other Aegean sites purple dye is found somewhat later than on Crete. The earliest known Aegean sites outside Crete that yielded evidence for purple dye are Kastri, Kythera dated to the late Middle Bronze Age,²⁸ Eleusis²⁹ and Asine.³⁰ Other sites of this Middle/Late Bronze Age transition have been excavated on the Turkish coast in Tavşan Adaşı and Troy, phase VI f–h.³¹ The bulk of the murex heaps in the Aegean are thus dated to the Late Helladic period, such as the Athenian Agora, Section ZZ, Room 2 Mycenaean well dating to LH IIIC late, Thessaloniki Toumba,³² Aghios Kosmas, Attica.³³ Magoula Pevkakia in Thessaly,³⁴ LH I–IIA Mitrou,³⁵ Ägina-Kolonna³⁶ and Akrotiri on Thera (Fig 11.2).

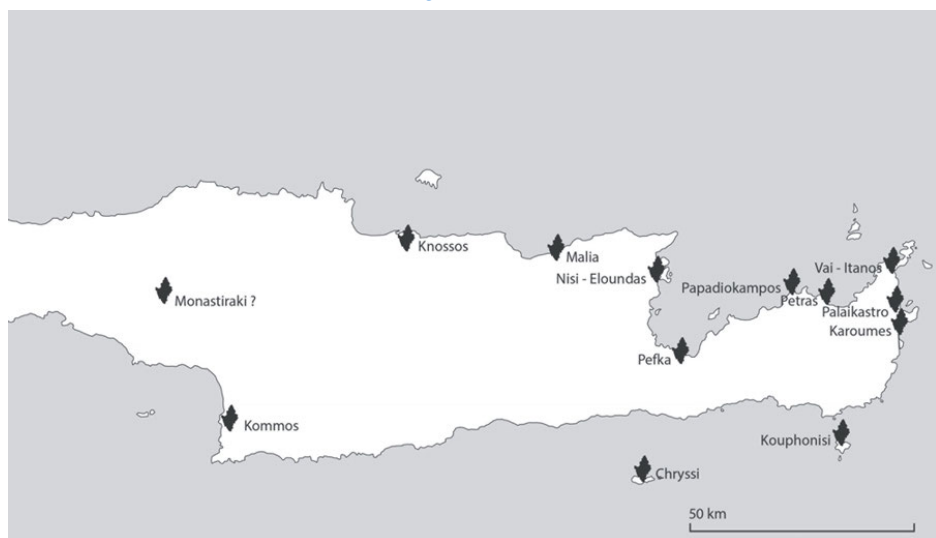


Fig. 11.1. Purple-dye production on Crete during MMI–MMII.



Fig. 11.2. Purple-dye production during the LHIII period.

The beginnings of purple dyeing in the Near East are more difficult to assess. Due to the abundant evidence for Phoenician purple-dye production, it was believed to be the cradle of this specific dye until Stieglitz's discoveries on Crete. Furthermore, the rich textual evidence from the cuneiform archives of the Near East has tainted our view. For example, the cuneiform tablets found at Nuzi from the middle of the 2nd millennium BC, mention the circulation of purple-dyed wool from the Syrian Coast to Mesopotamia.³⁷ But trade accounts like these should be treated carefully as they can be misleading. The text describes the trade of purple-dyed wool from the coast to inland Mesopotamia. The actual production place is however still unclear, as this wool could also have been dyed elsewhere and Syria might have functioned as an intermediary for the dyed wool, not its actual place of production.

The oldest archaeological traces of purple-dye production in the Levant have been found in the harbour town of Minet el-Beidha dating to the 15th–13th centuries BC.³⁸ The other sites on the Levantine coast, such as Akko,³⁹ Sarepta or Tell Abu Hawam,⁴⁰ however, date rather homogeneously to the LB II period. Furthermore, a 14th–13th century BC potsherd from Sarepta was analysed using Fourier-transform IR (FTIR) which documented traces of 6,6'-dibromoindigotin, a clear indicator for the use of purple dye. This find comes from Stratum V and can be dated to the transitional phase of the Late Bronze Age–Early Iron Age.⁴¹ The peak of the Levantine purple-dye production is reached during the Iron Age, (11th–10th century BC). The evidence for purple dye on Cyprus is scarce. At Hala Sultan Tekke crushed murex shells were found in contexts dating to the Late Cypriot III period.⁴²

This brief overview of the spread of murex dye in the Mediterranean lays the foundation for the rest of this study. A comparison between different regions on this scale faces the obvious problem of chronological uncertainties, as the various regional chronologies are difficult to compare in a precise manner. Nevertheless, it is likely that dyeing with purple emerged on Crete at the beginning of the 2nd millennium and was then practised in the surrounding Aegean and afterwards on the Levantine coast from the late 14th–13th century BC onwards. Interestingly, purple dyeing is found in the Levant at a moment when we can observe a decline in purple dyeing in the Aegean and more precisely on Crete. This coincidence might be directly connected but in order to pursue this, we will have to look for other cultural traits than heaps of crushed murex in order to construct a clearer picture of possible ways this technique might have spread. The distribution of Minoan pottery in the Aegean and Mycenaean pottery in the Levant suggests that the spread of purple dye can be linked to other archaeological phenomena. Specifically, the early settlements with purple dyeing in the Aegean show rather intense interaction with Crete, based on various Minoan objects. The site of Kastri, for example, has yielded not only a strong influence from Cretan material culture, but furthermore Cretan ceramics are found from the EB II period onwards.⁴³ It is therefore possible that the purple dyeing might have been directly introduced through an interaction with Crete. A similar trend seems to be the case for various other sites, such as Tavşan Adaşı on the Turkish coast where the appearance of purple dye is deeply rooted in an intense interaction with Crete as well. For the Levant we can observe an analogous situation. Purple dye is produced for the first time in a period of intense contact and exchange between the Aegean and the Near East, documented by the various objects of Mycenaean material culture found in excavations. This is especially important for some of the purple workshops there, as, for example, the abundant Mycenaean ceramics at Tell Abu Hawam demonstrate.⁴⁴ As intriguing as these coincidences are they are just a starting point to begin a discussion and do not constitute direct evidence in itself. To make this connection between the spread of purple dye and other elements of the material culture more plausible we should try to look for links between other objects related to dyeing or textile production with the appearance of purple dyeing, as the spread of a specific tool for textile production might be connected with the spread of another technology from the same semantic field as well.

The Minoan discoid loom weight in the Eastern Mediterranean during the Bronze Age

The Minoan discoid loom weight is an ideal object with which to explore the relationship between the spread of purple-dye technology and other textile techniques during the Bronze Age. First of all its origins can be securely linked to Crete and second it has a widespread distribution throughout the Aegean.⁴⁵

This distribution has already been recognised in the light of a transmission of technology, in this case a specific Cretan weaving style which is introduced to the Aegean,⁴⁶ and has made this loom weight a *Leitfossil* for the so called *minoisation*. The discoid loom weight was in use as a weaving tool on Crete since the late EM period. The EM IIB settlement of Myrtos Fournou Koriphi⁴⁷ or the EM II house D32 in Palaikastro⁴⁸ constitute good examples. It is subsequently found throughout the Bronze Age on Crete and is the dominant type of Minoan loom weight.⁴⁹ Besides this specific textile implement, the settlement of Myrtos is interesting in another aspect. Various spouted tubs have been found, such as the one in Area 8 which drains into a channel.⁵⁰ This sort of installation could theoretically have been used in the preparation of wool or for dyeing. Chromatographic analysis of a tub from Room 59 proved the presence of animal fat residues, which could be a further argument that this kind of installation may have been used for the washing of wool, dyeing or fulling, but more systematic research is needed. If we accept, however, this interpretation, it would be one of the first installations on Crete and in the Aegean connected to the treatment of wool.

Turning back to the discoid loom weight, its distribution outside Crete starts somewhat later than its initial use on the island. From the late Middle Helladic period to Late Helladic III it is found throughout the Aegean and the Turkish Coast (Fig. 11.3). Early finds of this loom weight have been found at Kastri, Kythera,⁵¹ Ayia Irini, Kea⁵² and Ägina-Kolonna.⁵³ The bulk of them date to the MM IIB and LMI A, as do the ones found on Rhodes.⁵⁴ As already noticed on Crete the discoid loom weight is found on some sites where purple dyeing has been attested to as well, such as at Troy⁵⁵, Kythera, Akrotiri, Tavsan Adasi and Chryssi on Crete. With the decline of the Minoan palaces in the Post-Palatial period, this loom weight goes out of fashion. The interesting point seems to be the general correlation of this textile tool with the spread of purple dyeing.

Apart from the typological similarities of the discoid loom weights, further evidence for its transmission from Crete can be noted. Macroscopic studies of the loom weights undertaken by Joanne Cutler on the fabrics of these loom weights in the Aegean revealed that the sources of some of the clay used to produce them were actually on Crete. At Ayia Irini on Kea c. 15% of the loom weights showed a clay composition with is not local to Ayia Irini but in some cases comparable to Crete; in Miletus 30 out of 213 loom weights are non-local and some of these showed a “Minoan signature”.⁵⁶ This may indicate a possible Cretan transmission of some of these objects and with it, most probably a Cretan weaving style. Moreover it is interesting to note that this discoid loom weight is the only type of Minoan loom weight which is found outside Crete. The reason for this specific selection of a single type of loom weight might be manifold and could be due to a specific type of cloth or a specific quality of textiles, produced on a warp-weighted loom, manufactured with this weight. In most cases the weight of the loom weight does not vary considerably, which

has been taken as a “standardised” quality of the woven fabric.⁵⁷ Experimental work has further demonstrated, that the rather light weight of the discoid loom weights (in average less than 100 g) was used to weave a very fine and high quality fabric.⁵⁸ Therein might lie a possible link between the discoid loom weight and purple-dye production, as fine fabric woven with these loom weights would be suitable to be dyed with one of the most precious dyes of the Bronze Age.

Textual evidence supports this assumption to a certain degree. In the Linear B documents you find only one type of textile which is explicitly labeled as shell purple-dyed, the *pu-ka-ta-ri-ja* type of cloth.⁵⁹ A theoretical reconstruction of the textile quality, based on the allocated wool for its production has, moreover, shown that it was a rather light woven fabric.⁶⁰ Returning to a more minimalistic point of view, we can observe that purple dyeing and the discoid loom weight – used to produce rather fine fabrics – both originate on Crete and have the same distribution pattern in the Aegean. It is therefore possible that this may reflect the production of fine, purple-dyed fabrics originating on Crete and then spread to the Aegean? More research is necessary to support this preliminary observation.

Aegean style loom weights in the Late Bronze Age Levant

As the beginning of purple dyeing in the Levant and Cyprus is more recent than the use of the Minoan discoid loom weight in the Aegean, it is not suitable as a possible marker to trace cross-craft interconnection in the textile production between these two regions. However, the loom weights are of a particular interest for this study. During the 13th–12th century BC two different loom weights suddenly appear in the Levant. Their rather abrupt and quick distribution marks the spread of an innovation in textile production in the Eastern Mediterranean.⁶¹ These types are the doughnut-shaped loom weight and the cylindrical or reel-shaped loom weight. The latter is usually coined as an “Aegean type” loom weight and has been widely discussed in the light of Aegean interaction with the Levant.⁶² And, indeed, it originates in the Aegean where it is found from the Middle Helladic period onwards.⁶³ During the Late Bronze Age these weights appear in Greece at numerous sites again, such as Pylos, Mycenae,⁶⁴ or Knossos.⁶⁵ The appearance of new types of loom weights in the Levant is particularly noteworthy, as during the Bronze Age there are only a few loom weights known in this area.⁶⁶ An explanation for this lack of loom weights has been the possible introduction of the horizontal ground loom during the Egyptian occupation of the Levant.⁶⁷ If we accept this view, these loom weights would be a marker for the reintroduction of the warp-weighted loom during the Early Iron Age.⁶⁸ During the Early Iron Age these types are found abundantly at different sites⁶⁹ and are, most often, the only kind of loom weight found in this region, as at Qubur el-Walaydah⁷⁰ or Ashkelon.⁷¹ On Cyprus they are also quite common and have been found for example at Kition

and Enkomi.⁷² Further examples have been found at Maa-Palaokastro,⁷³ all sites date to LC II. It is interesting that apart from their typological similarities with loom weights in the Aegean these loom weights are usually associated with Mycenaean pottery as at the Early Iron Age site of Tell Afis⁷⁴ or Tel Ta'yinat (Fig. 11.4).⁷⁵ Ta'yinat even provides us with further information; on the site the Aegean loom weights is closely related with the Mycenaean pottery appearing in the same contexts. With the decline of the LH IIIC pottery, the cylindrical loom weight is replaced by other types as well.⁷⁶



Fig. 11.3. Distribution of crushed Murex heaps and the Minoan discoid loom weight during MHIII-LHI.

The so-called doughnut shaped loom weight is a bit more difficult to assess. It has the same distribution pattern as the cylindrical loom weight⁷⁷ and appears as well during the 13th–12th century BC between mainland Greece and the Levantine coast. It has been found in LH IIIC Greece at Lefkandi and Tiryns.⁷⁸ Its distribution also includes Cyprus. In Area I 3.1 and Area II 3.1 at Sanidha dating to Late Cypriote II. Other finds on the island have been made at Kalavassos-Ayios Dhimitrios Square R14, Room1 dating to Late Cypriote IIC.⁷⁹ If there is any direct connection between the doughnut shaped weights and purple dyeing remains open. There is no clear contextual evidence. Furthermore, as the origin of this type of loom weight is less well understood it

remains difficult to relate to the spread of purple dyeing apart from the fact that both are introduced at the same time in the Levant. But the type of loom weight is clearly associated with a change in weaving technology in the Late Bronze Age Levant.

The cylindrical “Aegean” type loom weight, on the other hand, might be seen in the same respect as the spread of purple dye. Having its origins in the Aegean it is then distributed during the 13th–12th century BC to the Levant and follows the same distribution as purple dye. Furthermore it is frequently found together with Mycenaean pottery and features that might have been used as dyeing installations.

Evidence for dyeing installations

Dyeing workshops would of course provide us with the strongest evidence for purple dyeing. Unfortunately, our general understanding of such installations in the prehistoric Mediterranean is still at a very preliminary stage. This situation is partly due to the multiple ways dyes can be produced and the problem this causes in the reconstruction of the different steps of production, another is the archaeological problem of identifying dyeing installations. Although drainages, vats and clay coated basins are tempting to be seen as remains from dyeing workshops they could have had other purposes. As dyeing installations are not usually associated with a certain dye, the identification of dyeing workshops is just proof of dyeing, not of the use of purple dyeing. Therefore we need more systematical research of the archaeological context together with residue analyses in order to identify dyeing installations more securely. Such an approach was recently used in a re-study of the so called “bathtubs” in the Bronze Age Eastern Mediterranean. These tubs have already been associated with the bundle of “Aegean” innovations suddenly documented on Cyprus and the Levantine coast during the latest phase of the Bronze Age.⁸⁰ Similarly to purple dyeing, they originate in Crete, where they have been documented from the Middle Minoan III onwards.⁸¹ But as the case of Myrtos might show, objects like this are already known in the Late Early Minoan period. They have also been found on many sites of the Greek mainland as he recently restudied case of Late Helladic IIIB Thebes shows.⁸² Although their name suggests a non-economic function, this interpretation has recently been challenged. A careful re-assessment of the bathtub’s contexts in the Levant has demonstrated that they are usually found inside workshop areas and can therefore be connected to economic activity. This is one reason why their interpretation as bathtubs is now rather unlikely.⁸³ Furthermore, they are often found in contexts associated with textile tools and in particular with Aegean type loom weights, such as at Maa-Palaeokastro and Kition on Cyprus,⁸⁴ Ahsdod Area G,⁸⁵ Tel Miqne Ekron Building 351 and 359 as Temple 131 in Tel Qasile.⁸⁶ This strengthens the assumption that they are somehow associated with the production of textiles in general. One of the clear examples of this is the so-called textile workshop at

Kition Temple I, where the bathtubs are embedded in a huge textile workshop with dyeing installations, where possible mordants were identified by sediment analyses.⁸⁷ The precise function of these 'bathtubs' is, however, far from clear as there are different possibilities in which step of the *chaîne opératoire* they could have been used, such as dyeing, the washing of wool or fulling. Based on the finds of the Late Helladic IIIB workshop complex in Thebes, with its channels and vats their interpretation as fulling installations seems to be the most likely candidate.⁸⁸ However, multiple uses cannot be ruled out. Especially since fulling and washing would perhaps require the same features. As they are, moreover, closely associated crafts, it can be imagined that the washing of the raw wool and the finished cloth were undertaken in the same workshop, probably even by the same person. This is attested in later textile production. The Roman fuller was besides fulling and finishing textiles also responsible for washing textiles.⁸⁹ This Roman analogy is furthermore interesting, as it also illustrates a further cross-craft connection within the semantic field of textile production. In the industrial area of Roman Pompeii the fulling and dyeing workshops are situated in the immediate vicinity of each other.⁹⁰ Turning back from the interpretation of the precise function of the bathtubs to their distribution on Cyprus and the Levant, it is seems clear that their occurrence during the 13th–12th centuries BC is related to an Aegean involvement in the change of textile technology. The close architectural resemblance of the workshops and the similar outline in their features as at Tel Miqne/Ekron Building 353 and 354, Ashdod Area G, Tell Qasile Building 225 and Kition Temple I⁹¹ in which these bathtubs are usually found, show a certain common 'standard' for these workshops between Cyprus and the Levantine Coast. Furthermore, other changes in the textile production are visible from the Late Cypriote II period onwards. On Cyprus the previously domestic production of textiles is perhaps now organised in centralized workshops with washing and dyeing installations, such as at the workshop in Kition Temple I.⁹² As purple dyeing is attested to in Cyprus and the Levantine coast during the same period where we observe these changes in the production, it seems, in my view, likely that they should be treated in the same respect. Although we only have little direct evidence as at Tel Qasile where purple production is found as well.

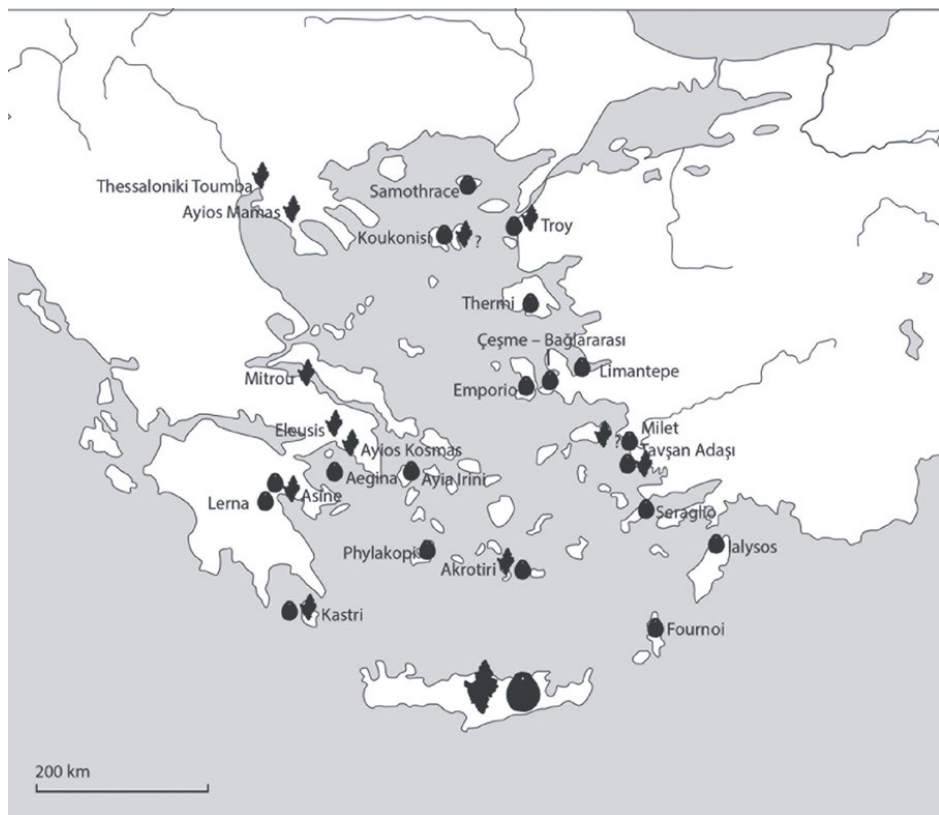


Fig. 11.4. Aegean style loom weights at the LB Levantine Coast.

Discussion

If we try to think more concretely about the mechanisms through which a technique is spread between different regions, it most probably involves some sort of mobility of the craftsmen/craftswomen.⁹³ The very nature of how crafts are learned in an active process makes this necessary. In order to master the repeated cognitive and physical acts involved in the learning process of a specific craft direct observation of an already experienced person in this craft is essential. The sequence of acts form the technological knowledge,⁹⁴ which can only be obtained by practicing this craft. This way of gaining technical knowledge is a crucial part of teaching and learning crafts and techniques in pre-modern societies. The mobility of craftspeople has been lengthily debated for the Eastern Mediterranean, with various degrees of mobility in the focus, ranging from intensified trade and itinerary exchange⁹⁵ to the actual migration of people and crafts persons.⁹⁶ Textile production has until now been left out in this discussion, but it should be embedded in it. Written accounts, in particular, are a valuable source with which to explore this topic more precisely compared to archaeology. The Aa, Ab and Ad Linear B tablets from Pylos for example, mention different kinds of textile workers, including toponyms of their origin. What is interesting with these toponyms is the fact that some of them point to

the Anatolian Coast and the East Aegean as the origin of these workers, such as Knidos (*ki-ni-di-ja*), Lemnos (*ra-mi-ni-ja*), Miletos (*mi-ra-ti-ja*) and Chios (*ki-si-wi-ja*). It can be argued for all of them that they had a specific task in the wide field of textile production, so we can hypothesize that these texts the presence of ‘foreign’ specialists in the Mycenaean Palaces.

Another interesting case concerning purple dyeing is found in the so called Manapa-Tarhunta letter (CTH 191) in the Hittite correspondence. This letter written by Manapa-Tarhunta, king of the Segar River Land to an unnamed Hittite overlord of the early 13th century BC⁹⁷ informs us about a dispute over purple dyers from the king,⁹⁸ which were taken captive by Piyamaradu. Of special interest is their origin, as they have been described as coming from *over the sea*.⁹⁹ Even though we cannot pin-point their exact origin to a certain place it is of a certain importance that they are already foreign to the region they are taken captive in and now brought to another place. This interpretation of the letter proposed by Singer would mean that this is the only account we have for the mobility of actual purple dyers.

This brief overview on the spread of purple dyeing in the Eastern Mediterranean has shown that there is much potential in embedding purple-dye production in the textile craft during the Bronze Age. This perspective enables us to think about the spread of this technology in other terms than an isolated view of the dyeing itself. Its spread to the Aegean must be seen in the increasing dominance of Cretan material culture to this region and the spread of Cretan textile techniques in general. A similar pattern is observable for the case of the Levant where purple dyeing is embedded in a package of innovation from the Late Bronze Age Aegean, especially in textile production.

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- 45 Cutler 2012, 147.
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- 47 Warren 1972, 212.
- 48 Burke 2006, 293.
- 49 Burke 2010, 56.
- 50 Warren 1972, 13.
- 51 Coldstream and Huxley 1972, 207.
- 52 Davis 1984, 161.
- 53 Gauss and Smetana 2007, 72.
- 54 Momigliano 2009, 124.
- 55 First evidence of purple dyeing and of discoid loom weights are both found from phase Troy VI onwards.
- 56 Cutler 2012, 149.
- 57 Davis 1984, 161; Burke 2010, 57.
- 58 Gleba and Cutler 2013, 118.
- 59 Palaima 1991, 277; Nosch 2011, 332.
- 60 Nosch 2012, 324.
- 61 Rahmstorf 2011, 321.
- 62 Bunimovitz and Yasur-Landau 2002, 216; Rahmstorf 2011.
- 63 Pavúk 2013, 124.

- 64 Karageorghis 2000, 263.
- 65 Warren 19883, 71, fig. 58.
- 66 Peyronel 2004, 201.
- 67 Yasur-Landau 2007, 670.
- 68 Cecchini 2000, 211.
- 69 Mazow 2005, 166.
- 70 Lehmann 2011, 289.
- 71 Stager 1991, 36f.
- 72 Karageorghis 2000, 263.
- 73 Karageorghis *et al* . 1982, 100; 1988
- 74 Venturi 2010, 8.
- 75 Harrison 2009, 183.
- 76 Harrison 2009, 183.
- 77 See Rahmstorf 2005, 57 for the distribution.
- 78 Rahmstorf 2011, 322.
- 79 South 1982, 66.
- 80 Karageorghis 2000, 266.
- 81 Karageorghis 2000, 273.
- 82 Mazow 2013, 219.
- 83 Mazow 2013, 217.
- 84 Mazow 2007, 294.
- 85 Bunimovitz and Yasur-Landau 2002, 214.
- 86 Mazow 2005, 44.
- 87 Smith 2002, 302.
- 88 Mazow 2013, 219.
- 89 Bradley 2002, 21.
- 90 Wild 2008, 475.
- 91 Mazow 2005, 346.
- 92 Smith 2002, 297.
- 93 Cutler 2012, 150.
- 94 Dosi and Grazzo 2010, 176.
- 95 E.g. Yasur-Landau 2010, 52; Sherratt 2003, 40.
- 96 E.g. Karageorghis 2000, 56.
- 97 Taracha 2001, 419.
- 98 Singer 2008, 26.
- 99 Singer 2008, 25.

Sacred colours: purple textiles in Greek sanctuaries in the second half of the 1st millennium BC

Cecilie Brøns

Introduction

Purple was one of the most important and prominent colours of antiquity. This seems to be no less true with regard to textiles in sanctuaries, where the majority of coloured garments described in the written sources are denoted as being of some nuance of purple. However, purple ranges from reds to blues, and several Greek terms were used to denote these different nuances. There are thus different terms for purple in the ancient written sources, among which the most commonly used are *halourgos* (which etymologically means “made from the sea”), *porphyra/porphyreos* and *phoenix/phoinikeos*. It has been argued that *halourgos* and *porphyreos* were not just colour adjectives, but also designations of colour material, and it is thus possible that these terms might refer to shellfish purple dye.

Literary sources and epigraphical evidence such as temple inventory lists provide evidence for the dedication of purple textiles. The evidence primarily belongs to the 4th century BC and later, which have lead scholars to conclude that these customs were rather late in the Greek world. However, this can very well be explained by coincidences of preservation, and the lack of written evidence cannot be used to reject that purple textiles were dedicated in earlier periods.

The present article seeks to clarify whether we can associate certain dyes with specific colour terms by juxtaposing the information we have of the purple colour of textiles in sanctuaries from selected written sources with our knowledge of ancient dyes. This will illuminate the possible appearance of the textiles dedicated in the Greek sanctuaries in the second half of the 1st millennium BC, their colour, and the dyes used to obtain them.

Juxtaposition of dyes and terminology

In some instances it seems possible to identify certain Greek colour terms with specific dye substances and thus the range of possible colours.¹ However, it should of course be noted that the range of colours also depends on the choice of fibre and mordants, the number of times the textile is dyed, the exhaustion of the dye bath etc.

Several terms that denote colours belonging in the purple range can be identified by epigraphical means. One such term is *halourgos*, derived from the Greek words “ἅλς” (sea) and “ἔργον” (work), and its primary meaning can therefore be translated as “made from the sea” or “wrought in or by the sea”.² Among the ancient literary sources that mention the word *halourgos* is the pseudo-Aristotelian treatise on colours which states that the colour *halourgos* derives from murex shell dye.³ It is therefore generally assumed that *halourgos* should be understood in the sense of genuine purple dye obtained from murex shells. As a result, scholarly research consider textiles, which are described with the adjective *halourgos*, as dyed with real shellfish purple, and the word is thus not just interpreted as an adjective, but also as a designation of material.⁴ It has been suggested that *halourgos* denotes a bluish purple,⁵ which makes it likely that it was made from *Hexaplex trunculus*, since this type of mollusc produces a violet purple.⁶

Phoinix is usually interpreted as denoting the colour red, for example, Kober claims that the colour indicated by *phoenix* included only the red purples, not the blue purples, based on its use in the literary sources to describe the colour of blood, roses, blushing, etc., leading to a modern perception of the word as denoting red.⁷ It could thus possibly derive from a red dye such as kermes or alternatively *Bolinus brandaris* or simply a plant dye such as madder.

The term *porphyreos* has the original meaning of shell purple; the term is derived from the word for purple shell and purple colour, and it can therefore be assumed that the word generally referred to so-called true purple. Thus, *porphyreos*, like *halourgos*, is not only a designation of colour, but also a designation of dye-stuff.⁸ However, this does not mean that all textiles designated *porphyreos* were dyed with real murex purple, at least not in later periods. For example, in Diocletian’s price edict (AD 301) under the heading *peri porphyras*⁹ are listed real purple as well as purple imitations made from plants etc., and some papyri from Imperial times attest the words *alethinoporphyros* or *pseudoporphyreos*.¹⁰ When it comes to its exact colour, some scholars, like Lyons, argue that it does not denote purple as we think of it today, but instead a particular kind of brilliant red.¹¹ An argument for associating *porphyreos* with the colour red is the translation into Greek of specific written Hebrew sources. In Hebrew there are two words for purple: the blue *tekhelet* and the red *argaman*, which is translated as *porphyra*. If it refers to a reddish shell purple, it could indicate an origin from *Bolinus brandaris* or *Stramonita haemastoma*, which both produce a violet-red purple.¹² However, this does not mean that *porphyreos* always denotes a red colour, but only when it is used in relation to *hyakinthos*.¹³

The word *hyakinthos* is commonly thought to describe the colour blue, primarily because of its use as a dyad with *porphyreos*.¹⁴ The word has no etymological relation to shell purple, but is originally the name of a violet-coloured flower.¹⁵ It has received great scholarly attention due to its relation to

the Hebrew word *tekhelet*, which many translators, philologists and biblical interpreters believe designates blue or a bluish purple.¹⁶ In the Hellenistic period, Jewish translations of the Bible into Greek appeared in which *tekhelet* was consistently translated by *hyakinthos*. Studies have shown that *tekhelet* was obtained from genuine shell dye,¹⁷ but whether this means that *hyakinthos* also derived from this type of dye is impossible to say. Perhaps the translation of *tekhelet* with *hyakinthos* only refers to the correct colour or optical experience, not necessarily the same dye. It is therefore possible that *hyakinthos* derived from a plant dye. In fact, grape hyacinth (*Muscari*), a bulbous plant growing in the eastern Mediterranean, could be used for dyeing a pale blue, and it is thus possible that the term refers to the dye substance.

Orphninos is a rare word denoting a colour occupying the borderland between purple and black. Xenophon uses it for dyed cloth, listing it between *porphyris* and *phoinikis*,¹⁸ while according to Plato *orphninos* is a darker version of *halourgos*: “Red blended with black and white makes *halourgos*; but when these colours are mixed and more completely burned, and black is blended therewith, the result is *orphninos*”.¹⁹ This suggests that *orphninos* denotes a very dark, almost black, shade of purple.

Other purple colour terms are likely to refer to plant dyes. *Erythros* is the basic word for red in ancient Greek, and *phoinix* and *porphyreos* are thought to be subordinate to it, like crimson and scarlet are subordinate to red in English.²⁰ In relation to textiles, the term presumably refers to madder-dye, since it is related to the name of madder, *erythrodanon*. Madder was an important red dye extracted from the root of the plant *Rubia tinctorium*, and it was well-known and cultivated in the Classical world, as a cheaper alternative to other and more expensive red dyes.²¹

Kyanos is claimed mostly to denote a dark blue,²² and is thought to have a nearly identical meaning to that of *melas* (black) in ancient poetic texts.²³ Democritus, quoted by Theophrastos, says that *kyanos* is a mixture of woad and “a shiny blue”,²⁴ possibly indicating that the term refers to a blue colour obtained from a plant dye. According to Forbes, woad came to Palestine and Syria as a cultivated plant in Hellenistic times from Greece, since its Syriac name is derived from the Greek *kyanos*,²⁵ thus providing a link between colour term and dye.

A final term to be considered here is *kokkinos*, which refers to kermes obtained from a small insect called *Kermococcus vermilio*. It produced a brilliant and colourfast dye and is claimed to be the source of the most highly prized and expensive red dye that ever existed.²⁶ However, dyeing was not necessarily restricted to the use of one specific dye substance and the mixing of different dyes was probably very common. For example, textiles dyed with shell purple could also be overdyed with kermes after mordanting with alum. The colour obtained by this process was called *hysginum*.²⁷ This phenomenon of mixing

dye-stuffs was also practiced with plant and mineral dyes, often with the goal of imitating true shell purple.

Evidence of purple dye from Greek sanctuaries

In Greece, purple dye-works have been archaeologically identified at several sites, e.g. on Delos where collections of *trunculus* shells have been recovered in five different places on the island, as well as stone blocks for breaking the shells.²⁸ On the island of Hagios Georgios, south of Cape Sounion near Athens, a 40 m long midden of shells as well as a number of small stone hammers used to break the shells has been found.²⁹ Purple dye-works have also been excavated on the Isthmus of Corinth, south of the sanctuary of Poseidon where remains of a textile establishment dating from Hellenistic times has been identified. Furthermore, shell-purple dye-works dating from the 6th–5th century BC have been identified in the north-eastern quarter of the Peribolos of Apollo at Corinth. At the site of Hellenistic Rachi at Isthmia a dye workshop possibly utilising shell dye has been uncovered and the island of Cythera has evidence of shell dye production from the Middle Minoan and later periods in the form of mounds of murex shells.³⁰ The majority of these examples appear to have been dye-works unrelated to sanctuaries or ritual, although at Corinth, the dye-works are located near sanctuaries and since Delos was a sacred island, this could possibly indicate some relation to ritual or religious economy. Clear indications of the production of mollusc dye from sacred contexts does exist, however: at the site of Kommos on Crete, the late 7th century BC building Q revealed considerable amounts of *trunculus* shells, half of which were used as secondary floor packing.³¹ And at the Peristeries sanctuary at Polis in north-western Cyprus enormous quantities of *trunculus* shells were recovered in a large *bothros*, testifying to purple-dye production.³²

Yet, murex shells have also been recovered from ritual contexts in more limited numbers. [Table 12.1](#) is far from exhaustive, partly due to the problem of these objects rarely being registered during early excavations, not to speak of being published, but it gives an idea of the phenomenon. With the exceptions of Kommos and the Peristeries sanctuary at Polis where dye-production was likely to have taken place, the numbers are very low. This indicates that production in these cases can be excluded. This is not necessarily surprising partly due to the fact that the sanctuaries were often quite remote and far from the sea, which would have made it very difficult to transport large quantities of live shellfish there. Furthermore, the shells are usually whole: if they had been used for dyeing, they would have exhibited breakages testifying to the extraction of the dye glands. Rather than indications of production, these shells were probably brought to the sanctuary as votive offerings – perhaps symbolising a kind of *pars pro toto* – as a substitution for a purple garment or an indication of the profession of the donor (even though it should be noted that murex snails were also edible, which could also explain their use as offerings).

Purple in the temple inventories

Textiles from ancient Greece are rarely preserved, and if so, they primarily come from burial contexts.³³ For an investigation of the colours of textiles dedicated in the sanctuaries, one must therefore seek other sources. One such source is the so-called temple inventories. These temple inventories reflect what was perceived as the most important objects and some confirm the presence of textiles, their type, fabrics and colours. So even though the textiles donated at the sanctuaries have disappeared today they occasionally survive in the lists preserved on stone. The term “inventories” generally refers either to catalogues of sacred property that was kept in the temple treasuries or to lists of votive offerings to the gods. They have been found in large parts of the Greek world, and generally span a rather long period from the 5th century BC to the 2nd century AD.³⁴

Purple garments are recorded in (at least seven) such temple inventories, spanning the period from the 4th to the 2nd century BC. Purple is mentioned in the inventories of the Parthenon (*chitōniskos*),³⁵ the Brauron clothing catalogues (*chitōniskoi*, *chitōn*, *xenike*, and as a substantive – *halourgida*),³⁶ the inventory of a temple of Demeter and Kore at Tanagra (*chitōnes*, a linen garment for a priestess (*lininos parporphyros*),³⁷ at Delos (*esthes*, *himation*),³⁸ the inventory of the Heraion at Samos (shoulder wrap or shawl (*proslēmma*), *chitōnes* and *chitōniskoi* with purple edges, *chlanides*, loin cloth, hair veil (*kekryphalos*),³⁹ the inventory from Thebes (*sinدونites*, *chitōnes*, *himatia*, ribbon)⁴⁰ and the inventory of Artemis Khitōnē from Miletos (*himatia*) (Table 12.2).⁴¹ These descriptions include garments completely purple or with purple stripes or edges. However, it should be noted that only in relatively few instances do the inventories describe the colour of the garments, but if so, they are usually purple, which thus appears to have been the most important colour to emphasise.

Table 12.1. Murex shells from Greek sanctuaries

Region	Site	Date	Type and no.
Attica	Altar of Aphrodite, Athens	5th century BC	1 (burnt) Murex
Peloponnese	Sanctuary of Demeter and Kore, Corinth	Archaic–late Roman	35 Murex
Peloponnese	The Acrocorinth sanctuary		106 Murex
Poros	Area H, Sanctuary of Poseidon, Kalaureia	EIA–Hellenistic	10 Hexaplex trunculus, 4 Murex
Poros	Peribolos, Sanctuary of Poseidon, Kalaureia	Archaic	20 Hexaplex trunculus, 5 Murex
Chios	The Athena temple, Emporio		16 Murex
Rhodes	La chapelle, Vroulia		2 Murex trunculus
Rhodes	The main sanctuary, Vroulia		“Many” Murex trunculus
Rhodes	Sanctuary of Athena, Lindos		7 Murex trunculus
Rhodes	Votive deposit, Kameiros		2 Murex
Crete	Sanctuary of Hermes and Aphrodite, Syme	MMIII/LMI	1 Murex brandaris, 2 Murex trunculus
	Viannou	& Protogeometric	fragments
Crete	Building Q, room 38, Kommos (floor packing)	Late 7th century BC	Sample of 4.4 kg. Murex trunculus
Crete	Temple B, Kommos	(c. 800–600 BC)	8 Murex trunculus
Crete	Temple C, Kommos	c. 400 BC–AD 150	8 Murex
Cyprus	Sanctuary of Apollo Hylates, Kourion	1st century AD	3 Murex
Cyprus	The sanctuary complex, Kition	LCHB–CGI	9 Murex
Cyprus	Sanctuary, Meniko “Litharkes”	CAII	1 Murex
Cyprus	The Peristeries sanctuary, Polis (Marion)	7th century BC	“enormous quantity” of Murex trunculus

Several terms, as described above, are used to denote the colour purple in the inventories: *halourgos*, *porphyreos*, *phoenix*, and *hyakinthos*, as well as *orphninos* (Table 12.3). However, the frequency by which these terms are used differs a lot. The word *phoenix* is only used once (in Brauron), while *hyakinthos* is used only in the inventory from the Heraion on Samos, and *orphninos* only in Tanagra. Finally, a ribbon is described as *kokkinos* in the inventory from Miletos, the only attestation of textiles certainly dyed with kermes. Thus the two most commonly used terms to denote purple in the inventories are *halourgos* and *porphyreos* and their compound terms.

The question is what this choice in terminology means? With reference to clothing, in the literary sources, *phoinix* has a particular association with military cloaks,⁴² which might explain the absence of the word in the inventories, since the most common garments dedicated in the sanctuaries appear to have been *chitōnes*, *himatia*, wraps, shawls, veils, children's clothing etc., and not military garments. This is supported by the fact that the only garment described with the term *phoenix* is a mantle (*chlaniskion*). Furthermore, the majority of the garments are dedicated by women, who perhaps dedicated their own garments. However, the different colour terms might also reflect the availability of different dyestuffs and thus regional variations in the choice of dyes. Table 12.1 also clarifies that the two respective words for genuine shell purple – *halourgos* and *porphyreos* – only rarely occur in the same inventory list. The only instance where the two words occur in the same inscription is the inventory from Miletos. This might of course only be a coincidence, and one should be careful on drawing conclusions from only seven inventories. However, the exclusive use of the terms might be explained by chronology, since the earliest inventories dating to the 4th century BC from Brauron and Samos only use the term *halourgos*, while the remaining, somewhat later, inventories – again with the exception of Miletos – use the term *porphyreos*. Perhaps the only term denoting textiles dyed with genuine shell purple in the 4th century BC was *halourgos*, while *porphyreos* also came to be used as an adjective describing textiles dyed with shell purple, but only from around the 3rd century BC. Alternatively, the contrasting terms could indicate a difference in the choice of votive gifts in the respective sanctuaries. Perhaps a certain nuance, colour or dyestuff was considered more appropriate than another.

Table 12.2. Garment types and purple terms in the temple inventories

	<i>Himation</i>	<i>Chitōn</i>	<i>Chitoniskos</i>	<i>Chlanis</i>	<i>Chlaniskion</i>	<i>Chlaidion</i>	<i>Tarantinion</i>	<i>Sindōn</i>	<i>Kekryphalos</i>	<i>Perizōma</i>	<i>Zōma</i>	<i>Proslēmma</i>	<i>Linos</i>	<i>Garmen</i>	<i>Skiton</i>	<i>Xenikē</i>
Halourgos	–	X	X	X	–	X	–	–	X	X	–	–	–	X	–	X
Meshalourgos	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–
Mesmohalourgos	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–
Parhalourgos	X	–	X	–	–	–	–	–	–	–	–	X	–	–	–	–
Platuhalourgos	X	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–
Porphyreos	X	X	–	–	–	–	–	X	–	–	–	–	–	X	–	–
Parporphyreos	–	X	–	–	–	–	X	–	–	–	–	–	X	–	–	–
Periporphyreos	X	–	–	–	–	–	–	–	–	–	–	–	–	–	X	–
Phoinix	–	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–
Hyakinthos	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Isatidos	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Parorphninos	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 12.3. Terms for the colour purple in the inventories

	<i>Parthenon</i>	<i>Brauron</i>	<i>Tanagra</i>	<i>Thebes</i>	<i>Delos</i>	<i>Samos</i>	<i>Miletus</i>
Halourgos	X	X	–	–	–	X	X
Parhalourgos	–	X	–	–	–	X	–
Meshalourgos/ mesmohalourgos	–	X	–	–	–	–	–
Platuhalourgos	–	X	–	–	–	–	–
Porphyreos	–	–	X	X	X	–	X
Parporphyreos	–	–	X	X		–	
Periporphyreos	–	–	–	X	X	–	X
Phoinix	–	X	–	–	–	–	–
Hyakinthos	–	–	–	–	–	X	–

Purple in clothing regulations

Purple garments are also recorded in the clothing regulations describing the prescriptions or prohibitions for entering specific sanctuaries. The clothing regulations relating to purple garments are only two in number. They both date to the 3rd century BC, and are respectively from Patras and Lycosoura (Arcadia). The former regards the goddess Demeter, and prohibits women from wearing purple (or brightly coloured) garments (*lōpion*),⁴³ while the latter prohibits all visitors to the sanctuary of Despoina from wearing purple, flower-decorated or black clothing.⁴⁴ Both regulations use the term *porphyreos*, either

as a garment term or for a garment or mantle. Two examples do not seem like much. However, there are several inscriptions prohibiting brightly coloured or decorated garments, which of course includes purple.⁴⁵ What is evident from these sources is the focus on the colour, rather than fibre or the type of garments, which may indicate that the colour purple was reserved for the deities.

Purple priestly garments

Alternatively, the purple colour could be a prerogative of the priestly personnel. Examples of purple priestly garments include those of the dignitaries of the cult of Demeter at Ephesos, administered by a local family called the Basilides, who had the privilege of wearing purple garments (*porphyrai*).⁴⁶

Other examples include a 2nd century BC inscription from the city of Skepsis in Asia Minor, which describes the official garment of the priests of Dionysos as a purple *chitōn*.⁴⁷ According to Strabo, Anaxenor, who was priest of Zeus Sosipolis at Magnesia on the Maeander, wore a *porphyra*.⁴⁸ Moreover, Athenaeus states that the priest of Herakles in Tarsos wore a purple and white *chitōn* (*porphyroun mesoleukon*).⁴⁹ Two inscriptions from Cos mention purple priestly garments: the first dates to the 2nd century BC and describes the dress of the priest of Nike.⁵⁰ During a procession in the month Petageitnos as well as during sacrifices and when in the temple, he wore a purple *chitōn*.⁵¹ The second inscription dates to the 1st century BC, and is connected with the cult of Zeus Alseios. It states that the priest(s) should wear a purple *chitōn* (*chitōna porphyrian*).⁵² Finally, in his speech *Against Andocides* from 400/399 BC Pseudo-Lysias provides evidence that the Eleusinian priests and priestesses wore purple garments (*phoinikides*).⁵³ It thus seems that, in some cults, priests were specifically required to wear purple garments.⁵⁴

Representations of purple garments

As shown, epigraphy and literary sources reveal a wealth of purple garments. Such colourful garments are sometimes represented in iconography and occasionally, traces of the original painting of sculptures and figurines are preserved. These instances provide us with the unique opportunity to recognise the colours of ancient garments and on occasion to relate specific garment terms with garments depicted in art. An example is a terracotta figurine from Athens, dated to c. 260 BC, rendering a woman clad in *chitōn* and *himation* (Fig. 12.1).⁵⁵ The figurine has clearly visible preserved colours illustrating the purple edges of her *himation* – perhaps what is described in the inventories as *parporphyros*, *periporphyros* or *parhalourgos*. Of course, we cannot tell whether the colours depicted are meant to represent genuine shell dye, but it gives an idea of how the garments described in the inventories might have looked.⁵⁶

Purple and social status

The fact that purple was the most commonly recorded colour in the inventories is perhaps not surprising, considering that it has been claimed to be the most important colour of Classical Antiquity, and that purple garments were worn historically by the rich and powerful of the Mediterranean – by deities, heroes, priests and rulers.⁵⁷ Due to its very high value, textiles dyed with shell purple signalled great wealth and high social status,⁵⁸ and fell into the category of social markers, expressing distinction in public as well as private life.⁵⁹ This notion of purple as a marker of high status is not restricted to the Hellenistic period. Homer employs the term to indicate high status, e.g. in the depiction of Helen sitting at home in Sparta spinning purple-dyed wool from a silver work basket.⁶⁰ This association with high value and status can of course explain the use of textiles dyed with shell purple in the sanctuaries and the restriction of their use by visitors. Yet perhaps this particular colour also had a cultic connotation besides it signalling great wealth. The sources examined here do not seem to indicate any special bonds with any particular deity. However, they are mostly related to female deities, which can probably be explained by the fact that textiles are more frequently recorded in inventories from sanctuaries for female deities.⁶¹



Fig. 12.1. Terracotta figurine, Athens, 260 BC. Woman with chiton and himation

Purple and sanctity

It is not unusual for red or purple colours being related to cult and sanctity. As a parallel, in Egyptian culture, red was considered a potent colour and was often associated with magical or ritual practices and with transitional or liminal areas.⁶² In Judaism, red is the Hebrew colour of God,⁶³ and red purple (*argaman*) was reserved for the cult of Yahweh in the temple and for the priest's robes, even though later, the kings of Israel also wore this colour.⁶⁴ In the Bible three purple dyes are recorded: red *tola'at shani* (made from kermes), blue *tekhelet* and red *argaman*, which are all listed around 30 times in connection with the sacred textiles for the Tabernacle and the veil before the Holy of Holies.⁶⁵ The hanging which separates the "Holy" from the "Holy of Holies" should be dyed with all three dyes, as should the priest's vestments. In contrast, the high priest's mantle, the bands attaching the pectoral to the *ephod* (ceremonial belt) and his diadem should be dyed solely with blue purple (*tekhelet*).⁶⁶ Furthermore, *tekhelet* was (and still is) used to dye the *tzitzit* of the Jewish prayer shawls,⁶⁷ which all indicates a strong connection between colour and ritual. According to Bélis, the use of shell purple was (and is) an expression of the anxiousness to make a strong distinction between the sacred and the profane, since Jews are not allowed to eat marine animals without fins or scales.⁶⁸ Perhaps the use of shell dyes not only carried a high social value, but also a ritual connotation as evidenced by its prominence in the written sources describing textiles in the sanctuaries. Furthermore, several sources testify to the use of purple garments for priestly personnel in ancient Greece, which could be an indication of the ritual connotations of the colour, even though it might only have been emphasised due to its high value.

Conclusion

To sum up, there is evidence to the use of purple garments as dedications and they were occasionally prohibited to visitors coming to the sanctuaries. However, it seems that purple was not merely purple. This is indicated by the use of different terms in the sources. The terms *halourgos*, *phoenix* and especially *porphyreos* and their compound terms were much more commonly recorded in comparison to *hyakinthos* and *orphninos*, which were only used rarely in these particular written sources, while *erythros* and *kyanos* are not recorded at all. This could indicate either that these terms were rarely used to describe the colour of textiles, or, in the case of *erythros*, that madder-dyed textiles were not dedicated (or at least recorded as such) in the sanctuaries.

As regards the garments, which are described as purple, no particular type is evident. Purple is used with regard to different types of garments, but primarily in relation to the *chitōn*, and secondly in relation to the *himation* and the

chitōniskos. However, this is probably merely an indication of these garment types being common during this period. Furthermore, there are two examples of purple ribbons. No link between garment type and colour term seems to exist, since for example the *chitōn* and the *himation* is described with *halourgos* as well as *porphyreos*. Yet, a possible exception is the *chitōniskos*, which only uses *halourgos* and its compound terms to describe the purple colour. Purple is also used to denote the colour of unspecified garments, or garments which are simply named by their colour – e.g. a *porphyris*,⁶⁹ a *phoinikis*,⁷⁰ or a *halourgis*.⁷¹ This indicates that the most important characteristic to record was often the colour, not fabric, type or other.

If the three terms (*halourgos*, *phoenix* and *porphyreos*) truly imply the use of shell dye, thus making them rather designations of dyestuff than colour, their frequent recording and prominence in the written sources can be explained by their extreme value due to the labourious process for the production of the dye where immense numbers of glands extracted from fresh shells were required.⁷² Additionally, this can explain why colour terms like *hyakinthos*, *orphninos*, *erythros* and *kyanos* were rarely (if at all) recorded or emphasised, since they were likely to have been obtained from plant dyes and therefore represent a lower economic value. This indicates that textiles dyed with madder (*erythrodanon*) were not recorded even though madder was a very common dye, while textiles dyed with woad (such as *kyanos*) were only very rarely recorded. Whether this indicates that textiles dyed with plant dyes were not (or only rarely) dedicated in the sanctuaries or simply not recorded remains impossible to answer. This raises further questions, for example how the individuals recording the textiles were able to distinguish between the different purple dyes used for the garments. Perhaps this was evident from the specific purple nuance or perhaps it was implicit, if only textiles dyed with specific dyes were dedicated. In sum, it is evident that the colour purple played an important role in the Greek sanctuaries, since this colour is the most frequently mentioned in the sources and its use appears to have been subject to restrictions.

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Abbreviations

BCH	<i>Bulletin de correspondance hellénique</i>
CAJ	<i>Cambridge Archaeological Journal</i>
CQ	<i>Classical Quarterly</i>
JHS	<i>Journal of Hellenic Studies</i>
LSCG	Sokolowski, F. <i>Lois Sacrées des cités grecques</i> . Paris 1969.
LSCGS	Sokolowski, F. <i>Lois Sacrées des cités grecques. Supplément</i> . Paris 1962.
MAA	<i>Mediterranean Archaeology and Archaeometry</i> .
SEG	<i>Supplementum Epigraphicum Graecum</i> , online edition, http://referenceworks.brillonline.com/browse/supplementum-epigraphicum-graecum .

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1For ancient theories of colour, see Stulz 1990, 23–95.

2Blum 1998, 26.

3Arist., *Col* . 4–5. Cf. Flemestad 2014, 208.

4Blum 1998, 27–28.

5Blum 1998, 26–27.

6Cardon 2007, 570, 579; Ziderman 1990, 99.

7Kober 1932, 93.

8Blum 1998, 31.

9Chapter 24.1.

10 Blum 1998, 31.

11 Lyons 1999, 68, 70.

12 Cardon 2007, 570, 579.

13 Blum 1998, 36–37.

14 Blum 1998, 37–38.

15 Blum 1998, 37.

16 E.g. Ziderman 1987.

17 Ziderman 1990, 98; 1987; 1981.

18 Xenophon, *Cyr* . 8.3.3.

19 Plato, *Ti* . 68c; Levides 2002, 14.

20 Lyons 1999, 59.

21 Forbes 1964, 107–08.

- 22 Deacy and Villing 2009, 116, 125.
- 23 Levides 2002, 16.
- 24 Theophrastos, *Sens* . 77; Platnauer 1921, 161.
- 25 Forbes 1964, 110.
- 26 Cardon 2007, 614; Karali and Megaloudi 2008, 182.
- 27 Cardon 2007, 570; Plin., *HN* 9, 140.
- 28 Cardon 2007, 569, 581. See also Bruneau 1969, 759–791.
- 29 Reese 2000, 644.
- 30 Reese 2000, 644.
- 31 Reese 2000, 645.
- 32 Reese 2010, 125.
- 33 Spantidaki and Moulherat 2012.
- 34 Scott 2011, 240. For textiles in the temple inventories, see Brøns 2015; 2016.
- 35 *IG II* ² 1475, line 7 (after 318/7 BC).
- 36 *IG I* 754-9; *IG II* ² 1514, 1515, 1516, 1517B, 1518B, 1521B, 1522, 1523, 1524B, 1525, 1528, 1529, 1530. 349/8, 348/7–336/5 BC.
- 37 *SEG* 43.212 (B), 3rd century BC.
- 38 *ID* 1442B, lines 54–56, 146/5 BC; *IG XI* ² 203A, line 73, 269 BC; *IG XI* ² 204, lines 75–76, 268 BC.
- 39 *IG XII* 6, 1, 261, 346/45 BC.
- 40 *IG VII*, 2421, 3rd century BC.
- 41 *Milet VI*, 3, 1357, 2nd century BC.
- 42 Aristophanes several times refers to *phoinikides* as cloaks, for example, he makes clear that Spartan men were so clearly visible because of their *phoinikis* , here understood as a purple military cloak: *Ar.*, *Lys* . 1140; cf. *Ach* . 320; *Pax* 1173, 1175.
- 43 *LSCGS* 33.
- 44 *LSCG* 68, *IG V* 2, 514.
- 45 E.g. *LSCGS* 32, from Arcadia, dated to the 6th century BC, which prohibits women from wearing brightly coloured garments in the sanctuary of Demeter Thesmophoros. Another example is *SEG* 36.267, from Attica, dated to 61/60 BC, which states that “ *the god forbids to carry in either coloured (garment) or dyed (garment) or...* [into the sanctuary]”. Translation: Lupu 2006.
- 46 Blum 1998, 96, *Str.*, XIV 1, 3; Nosch forthcoming b, 6.
- 47 *REG* 89, 1976, *SEG* 26.1334.
- 48 *Str.*, XIV, 1, 41.
- 49 *Ath.*, *Deip* . 5, 54; Patera 2012, 41, n. 17; Brøns 2016, 290.

50 LSCG 163.

51 The word for purple is restored *p* [*orph*] *yreon* ; another suggestion is a restoration as *p* [*anarg*] *yreon* .

52 Segre 1993, *ED* 215, lines 15–18.

53 Lys., *Andoc* . 51; Clinton 1974, 33.

54 Connelly 2007, 92; Brøns 2016, 292.

55 Staatliche Antikensammlungen und Glyptothek, Munich, inv. no. 727.

56 Another important group of artefacts testifying to the wealth of colours in Greek clothing are the Athenian white ground *lekythoi* . For an investigation of the colours of the clothing depicted on these, see Cleland 2002, 175–205.

57 Bradley 2009, 209; Bélis 1998, 295. For purple as a status symbol in antiquity, see Reinhold 1970.

58 Barber 1999, 117.

59 Bélis 1998, 295.

60 H., *Od* . 4, 125–135. For purple textiles in Homer, see Stulz 1990, 96–120.

61 Brøns 2015; 2016.

62 Spence 1999, 116.

63 Cage 1999, 110.

64 Cardon 2007, 572.

65 E.g. Exodus XXVI, 1, 31, 36; XXVIII, 6, 15, 31, 37; XXXIX, 1, 2, 8, 21, 22, 29, 30. Ziderman 1987, 25.

66 Cardon 2007, 581. Exodus XXXIX, 21, 22, 31.

67 Cardon 2007, 581.

68 Bélis 1998, 298.

69 E.g. Plut., *Aem* . 23.

70 E.g. Ar., *Ach* . 320; *Pax* 1173; *Lys* . 1140; X., *Lac* . 11.3.

71 E.g. Ar., *Eq* . 967.

72 Karali and Megaloudi 2008, 182; Ziderman 1987, 28. A single *murex trunculus* can produce 1.2 mg of dye, while a *murex brandaris* can produce 0.6 mg of dye. A single gland will dye 1 g of wool to a deep purple colour, Reese 2000, 643; 2010.

“A Lydian chiton with a purple fringe ...”: The gift of the garment to the Hera of Samos and Hera of Sele

Bianca Ferrara

Introduction

The use of purple in classical antiquity, which soon became synonymous with luxury and sophistication, has played a plurality of symbolic meanings closely related to the sphere of the sacred and to political power; here the practice of votive offering in the sanctuary of Hera at the mouth of the river Sele (Fig. 13.1) will be analysed.

The use of purple in the classical world can essentially be traced back to three main semantic fields:

- A symbol of divinity and expression of a priest's dignity in the system of votive offerings, the practice of supply of purple garments as a tribute and as a celebration of divine power;
- A symbol of luxury and opulence, also linked to the aristocratic practice of gift-exchange, as a sign of hospitality;
- A symbol of royalty and political power.

Important epigraphic evidence concerning the offer of garments is an inventory from the sanctuary of Hera at Samos. This inscription is dated to 346–345 BC based on the names of the archons, the local and the Athenian one, Samos being, in this period, a *cleruchia* of Athens.

The inventory meticulously listed the gifts to the goddess to be kept in her temple. The focus is on the offering of garments, reminiscent not only of the rite of dressing the cult statue. The list is significant and gives the clearest evidence for the forms of clothing, the highly differentiated use of fabrics, patterns, embroidery, and the use of purple returns as an element of sumptuous luxury.

“The kit of the goddess: Diogenes dedicated a Lydian chiton with sky-blue rim, a Lydian chiton with blue rim, a Lydian chiton with purple rim, a linen chitonisco with purple rim, a streaked chiton, a Lydian chiton with white rim, a simple bandage of coarse fabric, a *chitonisco* with a golden embroidered myrtle, a ragged linen coating; a small miter, this has the goddess; a cloak with a purple circle in the middle, a plain sheet outstretched before the goddess; a piece of poor fabric chiton, a fringed purple cloak for the goddess, two linen

cloths, seven veils, one carried by Euangelide; a purple embroidered consumed belt, a purple net outside, two simple stuffed pillows, a painted pillow...

Lydian chitons with purple rims, chitons from Trasianatte time, this has the goddess; two chitons from Ippodamante time, this has the goddess; from the time of demiurge Damasicleo a small purple cloak, this at the entry, from archon Demetrio time two chitons, this has the goddess ...

Philostratus recorded a girth band, a bandage, a veil, two small purple cloaks on the door of Hera, two coarse linen bandages, two chitons, Euangelide's garments, an ancient veil..."¹

The resulting use of purple is rather exceptional: it is used only for a coat or small cloaks, while the most common use is in beading or in a fringe, which underlines its opulence, a greater preciousness compared to many Lydian chitons.



Fig. 13.1 The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno). Aerial view.

In the custom of presenting gifts to the gods, therefore, the garment constitutes a constant and significant element. Literary and epigraphic documents provide various examples involving different gods, both female – just think of Athena Polias (Athens), Hera (Olympia and Argos), Artemis in Brauron – and male, such as Apollo at Amiklai, as Pausanias relates (VI, 24, 10):

“There is also in the marketplace a building for the women called the Sixteen, where they weave the robe for Hera. Adjoining the marketplace is an old temple surrounded by pillars; the roof has fallen down, and I found no image in the temple. It is dedicated to the Roman emperors”.

Pausanias himself also reports that:

“Each year the women weave a tunic for the Apollo at Amyclae, and they call Tunic the chamber in which they do their weaving ...” (III, 16, 2),

mentioning, at the same time, among the offering to Hera of Argos:

“a golden crown and a purple robe, offerings of emperor Nero” (II, 17, 6).

Moreover, there are many other references to purple in the ancient sources, where purple is considered a symbol of opulence and magnificence, and to the practice of presenting gifts as a sign of hospitality.

Several Homeric texts show the symbolic value of purple, related to the display of luxury and pomp, as the text in the *Odyssey* describing the preparation and setting of the sorceress Circe’s palace, in order to lavishly welcome Odysseus:

“But her handmaids meanwhile were busied in the halls, four maidens who are her serving-women in the house. Children are they of the springs and groves, and of the sacred rivers that flow forth to the sea, and of them one threw upon chairs fair rugs of purple above, and spread beneath them a linen cloth...” (X, 348–359)

Or the one in which he describes the embellishment of the Odysseus’ palace in Ithaca in order to deceive the suitors and be able to fulfil the massacre:

“Come, let some of you busily sweep the hall and sprinkle it, and throw on the shapely chairs coverlets of purple ...” (XX, 149–156).

In the *Iliad* there is a sacrifice that Hecuba performs in honour of Athena, to whom she presents the most precious of her peplums made at Sidon:

“But the queen herself went down to the vaulted treasure-chamber wherein were her robes, richly broidered, the handiwork of Sidonian women, whom godlike Alexander had himself brought from Sidon, as he sailed over the wide sea on that journey on the which he brought back high-born Helen” (VI, 286–292).

More often in the *Iliad*, purple underlines the royal status of many characters, e. g. when Agamemnon urges the Achaeans to battle (VIII, 213–227):

“And now was all the space that the moat of the wall enclosed on the side of the ships filled alike with chariots and shield-bearing men huddled together: and huddled they were by Hector, Priam’s son, the peer of swift Ares, now that Zeus vouchsafed him glory. And now would he have burned the shapely ships with blazing fire, had not queenly Hera put it in Agamemnon’s mind himself to bestir him, and speedily rouse on the Achaeans. So he went his way along the huts and ships of the Achaeans, bearing his great purple cloak in his stout hand ...”.

It also refers to Nestor, during the meeting of Argive leaders (X, 131–134):

“So saying he did on his tunic about his breast, and beneath his shining feet bound his fair sandals and around him buckled a purple cloak of double fold and wide, whereon the down was thick”;

and when the episode of Hector’s killing is told (XXII, 439–446, 795–800):

“So spake she weeping; but the wife knew naught as yet the wife of Hector for no true messenger had come to tell her that her husband abode without the gates; but she was weaving a web in the innermost part of the lofty house, a purple web of double fold, and therein was broidering flowers of varied hue ... The bones they took and placed in a golden urn, covering them over with soft purple robes”.

As a symbol of royalty, purple also recurs in the *Odyssey*, e.g. when Telemachus meets Menelaus (IV, 113–115, 147–154):

“So he spoke, and in Telemachus he roused the desire to weep for his father. Tears from his eyelids he let fall upon the ground, when he heard his father’s name, and with both hands held up his purple cloak before his eyes. And verily but now, as I made mention of Odysseus and was telling of all the woe and toil he endured for my sake, this youth let fall a bitter tear from beneath his brows, holding up his purple cloak before his eyes”;

or when Odysseus arrives among the Phaeacians, in which Homer uses the term ἀλπίορφυρα, sea purple, to distinguish it from the less valuable substance obtained through vegetable dyes (VI, 48–55, 300–307):

“At once then came fair-throned Dawn and awakened Nausicaa of the beautiful robes, and straightway she marvelled at her dream, and went through the house to tell her parents, her father dear and her mother; and she found them both within. The mother sat at the hearth with her handmaidens, spinning the yarn of purple dye. But when the house and the court enclose thee, pass quickly through the great hall, till thou comest to my mother, who sits at the hearth in the light of the fire, spinning the purple yarn”;

and when Odysseus among the Phaeacians, cries while Demodocus singing (VIII, 83–86):

“This song the famous minstrel sang; but Odysseus grasped his great purple cloak with his stout hands, and drew it down over his head, and hid his comely

face”;

and finally, when he comes back home and meets Penelope for the first time (XIX, 220–231, 241–243):

“Then Odysseus of many wiles answered her, and said: ‘Lady, hard is it for one that has been so long afar to tell thee this, for it is now the twentieth year since he went thence and departed from my country. But I will tell thee as my mind pictures him. A fleecy cloak of purple did godly Odysseus wear, a cloak of double fold.’”

Moreover, in the next piece he also refers to the practice of the gift as a sign of hospitality:

“I, too, gave him a sword of bronze, and a fair purple cloak of double fold, and a fringed tunic, and with all honor sent him forth on his benched ship”.²

During the 6th–5th centuries BC, purple has the same meaning. The tragic poets allude several times to purple as a distinctive sign of wealth display; in Aeschylus’ *Agamemnon* this value is closely intertwined to the expression of royalty (948–960):

“AGAMEMNON – Well, if you will have your way, quick, let someone loose my sandals, which, slavelike, serve the treading of my foot! As I walk upon these purple vestments may I not be struck from afar by any glance of the gods’ jealous eye. ... Since I have been forced to obey you and must listen to you in this, I will tread upon a purple pathway as I pass to my palace halls.

CLYTEMNESTRA – There is the sea – and who shall drain it dry? – producing a stain of abundant purple, costly as silver and ever fresh, with which to dye our clothes; and of these our house, through the gods, has ample store; it knows no poverty”.

The reference to purple as a symbol of royalty is also found in the fourth Pythian of Pindar, in reference to the story of the birth of Jason (IV, 109–118):

“And then secretly sent me away in purple swaddling-clothes, entrusting night with my journey, and gave me to Chiron, Cronos’ son, to raise ...”.

And later, in the 3rd century BC, Apollonius Rhodius in his *Argonautica* tells about the purple cloak given to Jason by the goddess Athena, still emphasizing its splendour, luster and shine as a symbol of royal power (I, 721–729):

“Now he had buckled round his shoulders a purple mantle of double fold ... More easily wouldst thou cast thy eyes upon the sun at its rising than behold that blazing splendour. For indeed in the middle the fashion thereof was red, but at the ends it was all purple, and on each margin many separate devices had been skilfully inwoven.”

The same meaning is in Strabo’s tale of the founding of Ephesus and the mythical king Androcolo (XIV, 1, 3):

“He says that Androclus, legitimate son of Codrus the king of Athens, was the leader of the Ionian colonization, which was later than the Aeolian, and that he

became the founder of Ephesus; and for this reason, it is said, the royal seat of the Ionians was established there. And still now the descendants of his family are called kings; and they have certain honors, I mean the privilege of front seats at the games and of wearing purple robes as insignia of royal descent, and staff instead of sceptre, and of the superintendence of the sacrifices in honor of the Eleusinian Demeter”.

And the purple garment was particularly luxurious and sophisticated, as proved in the episode of Alcistene, who donated it to the Goddess of Lacinio (Ps. Arist., *De mirabilibus auscultationibus*, 96, 838):

“They say that a cloak was made for Alcimenes, the Sybarite, so expensive that it was produced at Lacinium at the festival of Hera, to which all Italiots come, and was admired more than anything else displayed there; they say that Dionysius the Elder acquired it, and sold it to the Carthaginians for a hundred and twenty talents. It was purple, fifteen cubits in size, and on each side it was ornamented with embroidered figures, of Susa above, and of the Persians below; in the centre were Zeus, Hera, Themis, Athene, Apollo and Aphrodite. At one extremity was Alcimenes, and on either side Sybaris”.

This episode is set in the frame of a Pythagoreanism: the women of Croton, convinced by Pythagoras to leave the excess of aristocratic luxury, offer their own robes to the Heraion of Lacinio and the cloak is the expression of the close relationship between Sybaris and the Persian world; the iconography is chosen in order to put all the represented characters on the same level in such a way that they were easily recognizable to anyone who looked at this cloak, and this being of purple colour is a further element of preciousness that refers to the *tryphe*/luxury of Sybarites and Italiotes in general.³ The size of the cloak is about 15 cubits (6.6 × 14 m); worth 120 talents corresponding to the salary of 2700 mercenaries, therefore a truly remarkable piece of cloth.

These pieces of evidence make it clear how purple is considered a sign of opulence and how it is reserved for aristocrats or deities:

- It enhances the beauty of the bride (Ach. Tat., *Leucippe and Clitofonte* II, 11);
- Gives back Ulysses his royalty (Hom., *Od.* XIX, 225–235);
- It is generally associated with royalty (among the several homeric pieces, *Il.* III, 125–128; VIII, 213–217; X, 131–134; *Od.* VIII, 83–86);
- It is a symbol of luxury and pomp (Hom., *Od.* X, 348–359);
- It is related to the practice of royal and aristocratic giving (Hom., *Od.* XIX, 241–243);
- Defines a magistrate in his functions (Plu., *Life of Aristide* 21, 4–6).

These meanings continue in the Hellenistic period when the colour purple becomes a symbol of the tyrant, and the funerary objects found in the magnificent tomb of Philip the Second, father of Alexander the Great, in Vergina are wrapped in wonderful purple fabrics.⁴

For the Romans, purple also served as an external sign of dignity: a purple ruffle (*clavus*) overlapping the tunic indicated a membership to *Ordo Equester*, if narrow (*angusticlavium*), or to *Ordo Senatorius*, if large (*laticlavium*). *Magistrates*, as a distinction of their office, wore a purple stripe on their toga.

In the 9th book of his *Naturalis Historia*, Pliny describes different types of purple and its various uses and meanings in the Roman world (IX, 60, 127):

“In Asia the best purple is that of Tyre, in Africa that of Meninx and the parts of Gætulia that border on the Ocean, and in Europe that of Laconia. It is for this colour that the fasces and the axes of Rome make way in the crowd; it is this that asserts the majesty of childhood; it is this that distinguishes the senator from the man of equestrian rank; by persons arrayed in this colour are prayers addressed to propitiate the gods; on every garment it sheds a lustre, and in the triumphal vestment it is to be seen mingled with gold. Let us be prepared then to excuse this frantic passion for purple, even though at the same time we are compelled to enquire, why it is that such a high value has been set upon the produce of this shellfish, seeing that while in the dye the smell of it is offensive, and the colour itself is harsh, of a greenish hue, and strongly resembling that of the sea when in a tempestuous state?”

Moreover, Plinius considers it a symbol of the worst luxury due to its frailty and ephemeral duration.

Quintilian, in his *Institutio Oratoria*, says that the use of purple does not suit children in diapers or the elderly (I, 2, 6):

“Would that we did not too often ruin our children’s character ourselves! We spoil them from the cradle. That soft upbringing, which we call kindness, saps all the sinews both of mind and body. If the child crawls on purple, what will he not desire when he comes to manhood? Before he can talk he can distinguish scarlet and cries for the very best brand of purple. We train their palates before we teach their lips to speak”

(XI, 1, 31): “Again, different kinds of eloquence suit different speakers. For example, a full, haughty, bold and florid style would be less becoming to an old man than that restrained, mild and precise style to which Cicero refers, when he says that his style is beginning to grow grey-haired. It is the same with their style as their clothes; purple and scarlet raiment goes ill with grey hair”.

Suetonius, in the life of Nero, tells of the nefarious measures taken by the Emperor Nero to accumulate more and more wealth and restrictions he imposed on the use of purple (XXXII, 3, 3):

“Having forbid any one to use the colours of amethyst and Tyrian purple, he privately sent a person to sell a few ounces of them upon the day of the Nundinae, and then shut up all the merchants’ shops, on the pretext that his edict had been violated. It is said that, as he was playing and singing in the theatre, observing a married lady dressed in the purple which he had prohibited, he pointed her out to his procurators; upon which she was

immediately dragged out of her seat, and not only stripped of her clothes, but her property”.

Symbolic value of the garment and especially of the colour

Ever since the use of purple was introduced into the Western world, it immediately held, because of its preciousness and rarity, a highly symbolic value, with a strong sacral or political connotation.

In the Greek world, as well as being an expression of royalty, the use of purple seems to prevail especially within the religious sphere: purple garments are given as gifts to the gods, as in the case of Artemis Brauronia or Hera of Samos.⁵

But the offering of a garment also implies a cautious and functional selection of colours: the offerings to Artemis Brauron are the same as those for Hera at Samos, but the *himation* is white, with a purple rim, and a saffron garment, a colour assumed as symbolising the fur of the bear, a ritual in which disguise was required for the girls in order to expiate an old guilt.

A white garment also characterises the young Arrephoroi. Black instead is rather clearly, peculiar to mourning rites, such as that celebrated in Corinth in honor of Medea's children: seven boys and seven girls wore black garments and shaved their hair. Therefore, the colours of garments are linked to a specific symbology, different for white or yellow or black, while red/purple colour remains strongly anchored to the symbolism of luxury, preciousness, regality.

The *Peplophoria* rite

The presence of garments in sanctuaries or among the votive gifts is part of an offering ceremonial rite and does not necessarily imply a *peplophoric* rite.

The gift of the garment is indeed part of initiation rites, and dressing is related both to female and male puberty and to the rite of passage. As Burkert well proved, one of the essential moments of the ritual was changing the clothes and wearing a new garment to show off during the procession.⁶ Thus at the time of the wedding, as the gift of a ball or of a small doll marks the transition from one state to another, the gift of the belt or the hairnet fall into the same frame of meaning. And sometimes the belt is purple and, more rarely, even the hairnet can have a border of purple.

The issue of the *peplophoria* obviously involves more than one god: the rite is well attested to for both Athena, with the famous college of Athenian Arrephoroi, and Hera at Olympia and Argos.⁷ Hera was bestowed with offerings of garments, and we know about the procession of the cult statue and its dressing during the celebrations in her honour. Callimachus tells about the aristocratic girls of Argos weaving the tunic for Hera. In Olympia:

“A building was built in the agora, and by means of sixteen convened women, there the peplos for Hera was woven” (Paus. VI, 24, 10).

Therefore, the strong link between Hera and *peplophoria* is well attested. An example was given in the 1990s by Giovanna Greco, as a prime example of the *peplophoric* rite taking place in the sanctuaries of Hera also in Western Greece, actually even in the case of the square building located in the sanctuary of Hera at the mouth of the river Sele where a ritual ceremony probably linked to the weaving and the gift of the garment to the goddess, as part of the initiation rites, related both to women and men, within which the dressing ritual assumes a strong symbolic value, stressing the transition from puberty to adulthood.⁸

The building is located behind the two monumental altars, the ideal centre of the sacred area, and about 80 m away from the temple of the goddess. The perfectly square plan (12 × 12 m) outlines a central space free from internal structures marked by cut walls protruding inward at a right angle. On the south side, flanking the entrance, stand two of these cut walls, whose function is still much discussed (Figs 13.2–13.3). Inside was the only marble statue of the goddess found in the sanctuary (Fig. 13.4).⁹

Almost all objects mutually agree on a *mundus muliebris*. With regard to vascular forms there is a high prevalence of vessels related to the nuptial rite (large amphorae, craters, *hydriai*, *pelikai*, *lebetes*, approximately 29 *lekanai*, *lekythoi*, bottles, all forms that in their diversity of use and functions reflect a female universe (Fig. 13.5). This is, moreover, also largely confirmed in the choice of the figurative scenes; a group of ring *askoi*, over 90 *unguentaria*, several pyxides also miniature, and a very substantial quantity of tableware (plates, cups, paterae, glasses and pitchers) and kitchenware (pots, jars, etc.), coins. Small gold jewellery, coral, amber, ivory and bone items confirm the hypothesis provided by vascular evidence.

The presence of a golden bulla decorated with a circular granulation (Fig. 13.6), should be underlined; this is an item having its reproductions within the rich Etruscan-Italic production, where it is attested in female kits, very often associated with crowns, and where it symbolises youth.¹⁰

The several iron keys, of different forms, even miniature, also lead back to an all-female rite and constitute a class of *ex-voto* objects constantly present in shrines associated with goddesses.

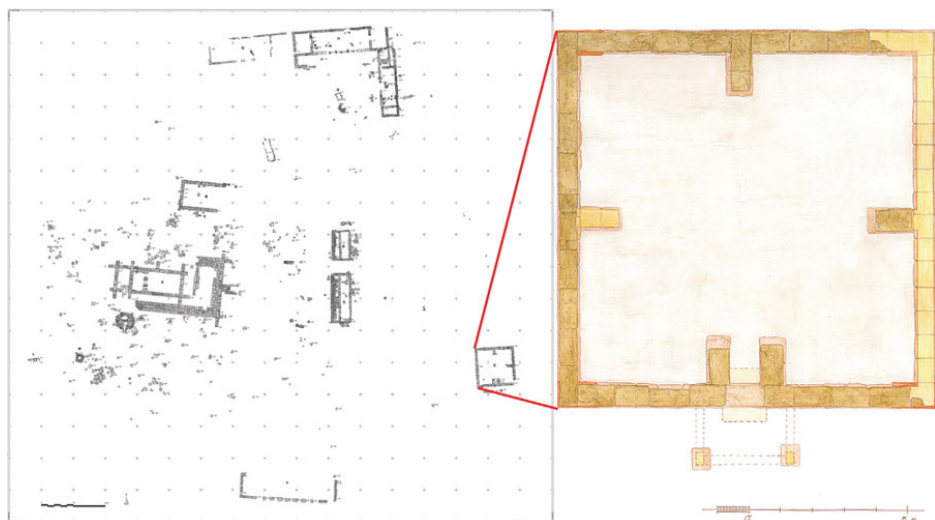


Fig. 13.2. The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno). General plan including buildings and monuments ranging in date from the 6th to the 3rd century BC and detailed plan of the so-called Square Building.

Particularly interesting is a set of clay objects. About 300 clay loom weights, pyramidal- and discoid-shaped, were found in the square building (Fig. 13.7). Paola Zancani divided them into seven groups on the basis of their weight differences, very cautiously advancing the hypothesis of their weight value; her hypothesis was immediately challenged by Mingazzini, who interpreted them rather as real loom weights.¹¹

Therefore, it can be assumed that in the square building there were on average between three and four looms, of vertical type, with an upper roller swivel and side posts fixed into the ground, placed on the sides, divided by cut walls creating real divisions of the weaving workspace (Fig. 13.8). In such an unusual building a proper weaving activity aimed at a very specific rite peculiar to Hera, but not exclusive of this goddess, most probably took place.¹²

The *peplophoria* rite is widely attested in the mythography of Hera and occurs both in epigraphic and literary tradition; during the religious rite, after the ritual bath which returned virginity to the goddess and the disclosure of the *simulacrum*, dressed by priestesses and carried in a procession.

The *peplophoria* rite is associated on the one hand to weaving and the presence of girls in charge of this honour, and on the other to the existence of buildings meant for such use.

But the presence of girls who were usually chosen within the local aristocracy, and who lived for a certain period isolated from society, with weaving and the economy of the *oikos* among their tasks, brings to mind, as also pointed out by Brelich, the initiation rites related to female universe and *gamos*.

Therefore, there are many elements in the square building that can support

this hypothesis. Among them the perfectly square plan referring to the canonical *oikos* plan as an environment kept for hearth and woman, the internal partition suggested by brick buttresses, and especially the existence of a second floor justified by the need to allocate beds for the girls who lived in the sanctuary (Fig. 13.9). Moreover, the presence of tableware and kitchenware underpins the practice of community meals, votive gifts allude to weddings, and the presence itself of the statue of the goddess who supervises the initiation period of the girls, ensures the highly ideological sacredness of the area.

The building reveals adherence by new users of the sanctuary, the Lucanians, to Greek cultural models for educating the youth, and the spread of Pythagoreanism among Italic peoples in relation to their aristocracies which fully illustrates the complexity of the meeting between two different cultures, and highlights the receiving life patterns marked by an aristocratic ethic of Greek mould. These Greek-Samnitic societies had lifestyles fully modelled on Greeks, and a particular value was strongly attributed to initiation for both men and women¹³.

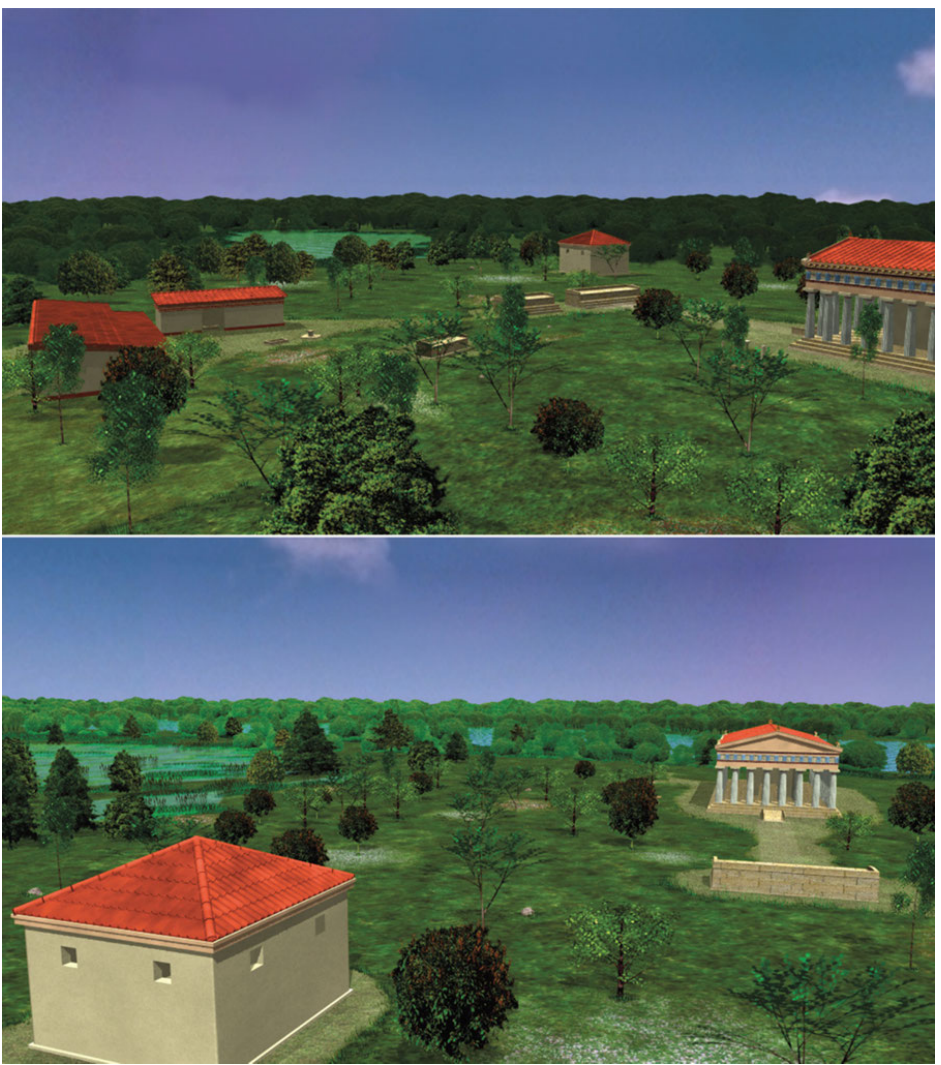


Fig. 13.3. The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno). 3D reconstruction of the sacred area during the Lucanian period. In the background (upper image) and in the foreground (lower image) the so-called Square Building.



Fig. 13.4. The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno). Paestan red figured amphora, Paestan red-figure krater, black-glaze double-handled cup, black-glaze bottle, and unguentarii from the so-called Square Building.



Fig. 13.5. The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno). Etruscan-Italic golden bulla from the so-called Square Building.



Fig. 13.6. The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno). Loom weights from the so-called Square Building.

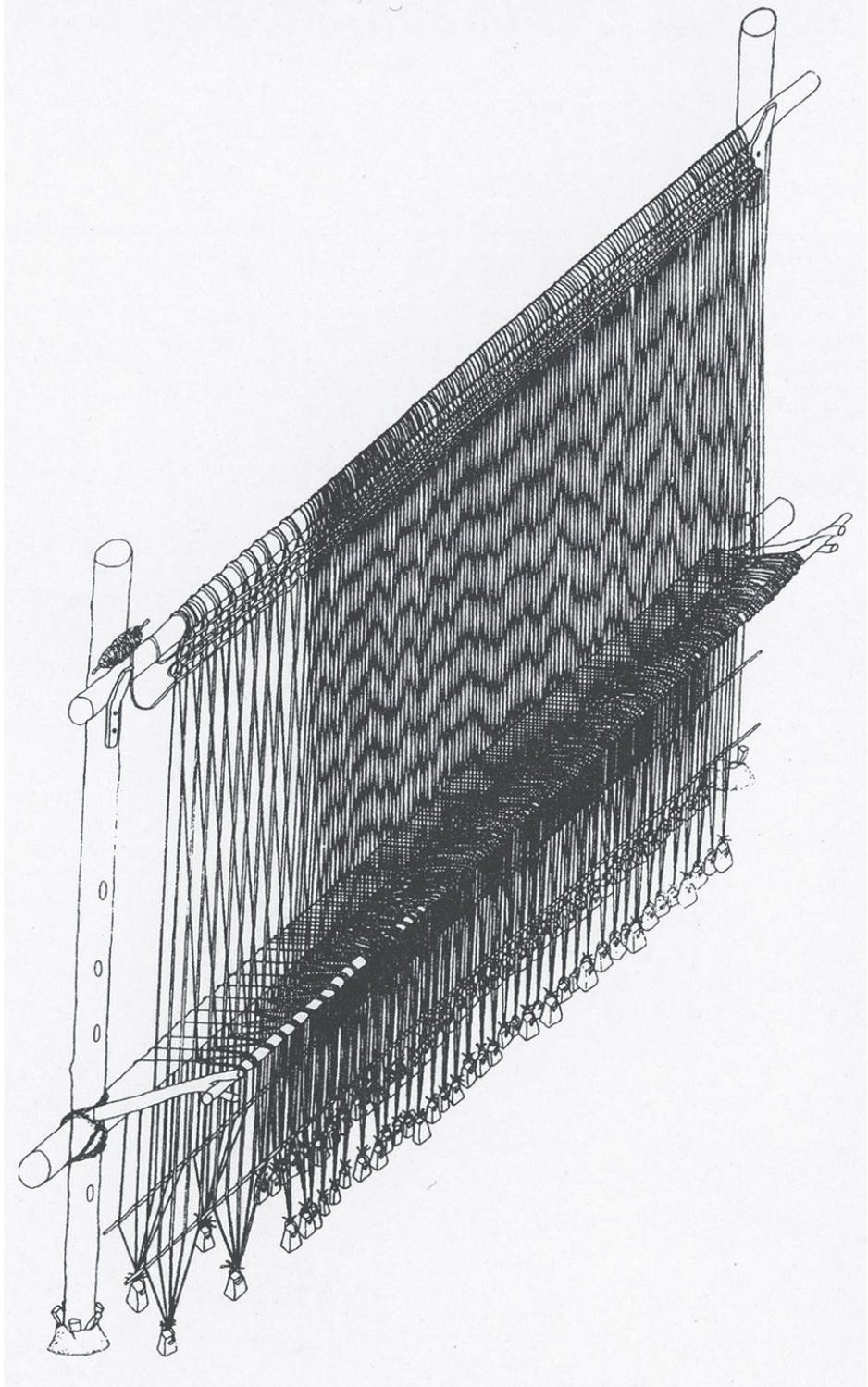


Fig. 13.7. The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno). Reconstruction of a typical vertical loom placed in the so-called Square Building.

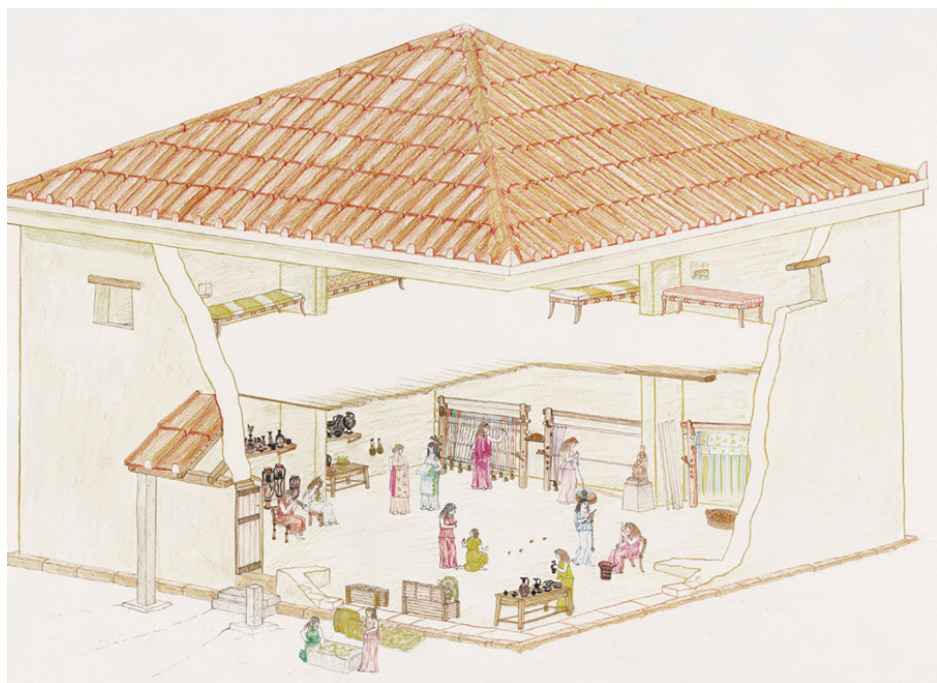


Fig. 13.8. *The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno). Hypothetical reconstruction of the so-called Square Building.*

It may thus be of a certain value to hypothesize that the square building played a special role probably related to both a *peplos*-weaving ceremony to the goddess and to the initiation period for the local aristocracy girls, ahead of their inclusion into society with a different role, as it is recorded in many other Greek and western-Greek sites. Male and female rites of passage, in fact, were usually celebrated in several extra-urban sanctuaries, such as the Heraion at the mouth of the river Sele, often situated on or near the frontiers, in a laminar position, also emphasising the significance of the initiation rituals that were performed.

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Fig. 13.9. The Sanctuary of Hera at the mouth of the Sele River (Paestum, Salerno).

Marble statue representing the goddess Hera from the so-called Square Building.

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1Ohly 1953.

2Besides these references, we find many passages related to weaving or the use of purple in ancient literary sources. In Homer, purple clearly becomes a symbol of royalty and it is often presented as the main activity to which the regal brides of princes or kings devote themselves (Il. III, 121, 125–128): “But Iris went as a messenger to white-armed Helen...She found Helen in the hall, where she was weaving a great purple web of double fold, and thereon was broidering many battles of the horse-taming Trojans and the brazen-coated Achaeans, that for her sake they had endured at the hands of Ares”.

3Bugno 1999, 18–19.

4Cardon 2007, 572–573.

5Brøns 2015.

6Burkert 1987.

7Greco 1997, 194–195, n. 32.

8Greco 1995; 2003.

9Zancani and Stoop 1965–66.

10 Franco 2014.

11 Mingazzini 1974.

12 Greco 2012, 211–216.

13 Mele 1991; 1994.

Purple for the masses? Shellfish purple-dyed textiles from the quarry workers' cemetery at Strozzeacaponi (Perugia/Corciano), Italy

Margarita Gleba, Ina Vanden Berghe, Luana Cenciagli

Introduction

Among ancient dyes, shellfish purple stands in a category of its own. It was arguably the most famous dye of antiquity, associated with kings and highest ecclesiastical orders of many civilisations around the world. Purple dye was extracted from the hypobranchial gland a variety of marine molluscs, most notably *Hexaplex trunculus* (old name *Murex trunculus*), *Bolinus brandaris* (old name *Murex brandaris*), *Stramonita haemastoma* (old name *Purpura haemastoma*) and other species.¹ It has been hypothesised that vast quantities of molluscs were needed to produce even a small amount of this precious dye. Practical experiments extracting the hypobranchial glands from 12,000 molluscs resulted in only 1.4 g of pure colourants.² Consequently, large crushed shell heaps documented throughout the Mediterranean from the Middle Bronze Age onwards³ are generally regarded as a by-product of the purple-dye industry.

Direct evidence of shellfish purple dyeing, consisting of dye traces in dyeing installations or textiles dyed with shellfish purple, is, on the other hand, exceedingly rare. The earliest dye traces have been identified at Pefka and Kommos on Crete and are dated to the Protopalatial period.⁴ They have also been found on the inner surface of pottery fragments from the Late Bronze Age Sarepta in Lebanon⁵ and various Iron Age sites in Israel.⁶

Shell purple dye has been identified in relatively few textiles, almost invariably of exceptional quality and prestige. The earliest shellfish purple-dyed textiles known to date were found in the Bronze Age royal burial in Qatna, Syria.⁷ Almost a millennium later in date, are traces of shellfish purple dye on what is believed to have been a garment of a Phoenician priest buried in a monumental tomb in Cádiz, southern Spain.⁸ Purple has been identified in the wool fabric discovered in the fifth barrow of Pazyryk in the Altai Mountains of Siberia.⁹ During the Hellenistic period, the purple and gold textiles became particularly popular among the Mediterranean elite. The most complete and the most magnificent surviving example of purple and gold tapestry comes from the so-called Philip's Tomb in Vergina, Greece, and is dated to the 4th century BC, where it was used to wrap the cremated remains of a dead woman.¹⁰ Their

popularity continued into Roman times,¹¹ and the majority of textiles with identified shellfish purple dye are dated to the Roman and later periods. They have been found in various parts of the Mediterranean region. At least 12 of the analysed textiles from Palmyra, Syria tested positive for shellfish purple dye.¹² Numerous examples are known from Egypt¹³ and Israel.¹⁴ Fragments of dress made of Chinese silk dyed with shellfish purple dye and embroidered with gold thread were found in a burial of a rich Sarmatian lady at Sokolova Mogila in Ukraine.¹⁵ However, new evidence indicates that, at least before Late Antiquity, shellfish purple dye was available not only to the highest classes of society.

The quarry-workers' cemetery at Strozzacapponi

The finds presented here come from the Hellenistic necropolis of Strozzacapponi, situated at the present-day boundary between the communes of Perugia and Corciano, in the Italian region of Tuscany. This zone was and still is rich in deposits of travertine, abundantly quarried since ancient times both for building materials and for craftwork. Recent investigations have demonstrated that the walls of the Etruscan city of Perugia were built using stone from these quarries. During the Hellenistic period (4th–1st centuries BC), a settlement was constructed in the area around the quarries, which was likely inhabited by the people who worked there. No traces remain of this settlement, but a large necropolis in which its population was buried was discovered by chance during construction work. It was explored already in the 19th century and later in 1960–1970s by the Soprintendenza Archeologia, Belle Arti e Paesaggio dell'Umbria, and consists to date of about 100 subterranean (*hypogaeum*) tombs. The tombs are mostly of the same chamber type, with an entrance *dromos* and stairs. Inside, the rectangular chambers have benches for placing the cinerary urns and the burial offerings, which in general are relatively modest.

Recent excavations, conducted by the Soprintendenza in connection with the construction of a roundabout, brought to light 47 new Etruscan *hypogaeum* tombs, dug into the travertine: 34 chamber tombs and 11 fossa graves dated to the 2nd–1st centuries BC.¹⁶ Because the necropolis is located on the boundary line between the communes of Perugia and Corciano, the finds are currently divided between the Soprintendenza Archeologia, Belle Arti e Paesaggio dell'Umbria in Perugia and the Antiquarium of Corciano. Some of the burials had been looted in antiquity but others were intact. The urns in travertine containing cremated remains are usually undecorated, although they often have the name of the deceased carved or painted on the lid. Many of the urns contained textile remains, all heavily mineralised. In several cases the textiles preserved traces of intense pink or purple colour and four samples were selected for further analysis.

Purple-dyed textiles

The first sample derives from the richest Tomb 29 (Perugia) called “Tomba dei Letti Funebri” and identified by inscriptions as belonging to the Anei Marcna family.¹⁷ The tomb was intact when discovered. It is preceded by a long *dromos* and was sealed with a travertine block. The square burial chamber has a central pillar, benches that run along three walls and a central recess. On the benches were eight funerary urns in travertine decorated with sculptural reliefs emphasised in vivid reds, blues and blacks. Each lid has a reclining figure representing the deceased and an inscription in red paint referring to the family of Anei Marcna. The urns are decorated with various motifs: a married couple, the siege of a city, a battle between Centaurs and Lapiths, Scylla, a female figure on a marine monster and a bucranium. The burial goods found deposited around the urns, at the base of the benches and in the recess include ceramic vessels, miniature vases, perfume containers (*unguentaria*) and plates. The polychrome urns and the rich burial goods belong to a family of considerable means, which is surprising since the rest of the tombs appear to be of persons of relatively modest means, as expected for quarry workers. Urn 5 with a lid depicting a recumbent male deceased and the box depicting Scylla contained numerous textile fragments of light purple-pink colour (Fig. 14.1), the largest measuring c. 3.0×1.5 cm. The textile is an open tabby and has approximately 30–40 threads/cm in both systems; it is woven in z-twisted yarn of variable diameter (0.1–0.3 mm). The technical characteristics of the textile fit well within the existing corpus of Etruscan textiles.¹⁸

The second sample derives from the travertine Urn 4 found in a looted burial chamber of Tomb 10 (Perugia). The urn, consisting of a lid depicting a recumbent female deceased and the box depicting a combat scene, was found on the left bench. It contained a completely calcified block of a textile in numerous layers, measuring c. $10 \times 10 \times 10$ cm (Fig. 14.2). The structure of the textile is no longer identifiable but more than 20 layers and numerous folds are discernible (Fig. 14.3). At the bottom of the block several layers of bright purple colour are clearly visible.

The third sample (Fig. 14.4) comes from a broken pottery vessel used as a cremation urn in Tomb 24 (Corciano), which had mineralised textile traces preserved on the inside at the bottom. The textile is a very fine unbalanced (probably weft-faced) tabby. Its thread system A (probably warp) consists of white, tightly spun, z-twisted threads 0.2–0.3 mm in diameter and has 22 threads/cm, while system B (probably weft) is made up by extremely fine, very bright purple threads of indiscernible twist (or possibly untwisted), 0.1–0.2 mm in diameter and has c. 70 threads/cm (Fig. 14.5). This textile is of extremely fine quality and its presence in a clay vessel is rather unusual.



Fig. 14.1. Textile fragment with purple dye traces from Tomb 29, Stroz Zacapponi-Perugia (photo: M. Gleba).

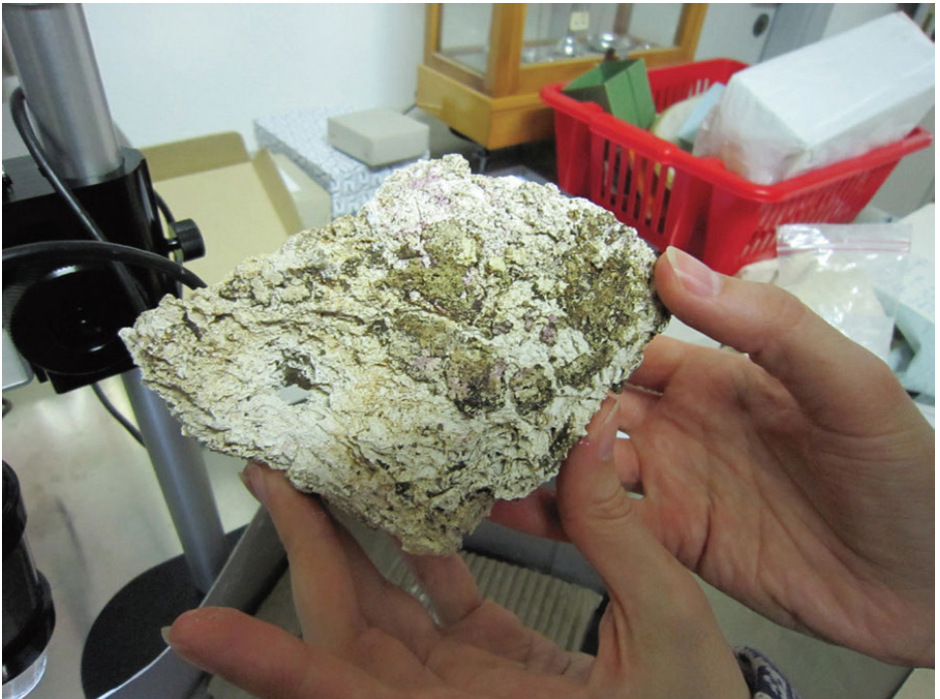


Fig. 14.2. Calcified textile block from Tomb 10, Stroz Zacapponi-Perugia (photo: M. Gleba).

Gleba).



Fig. 14.3. Close-up of purple textile layers within the calcified textile block from Tomb 10, Stroz Zacapponi-Perugia (photo: M. Gleba).

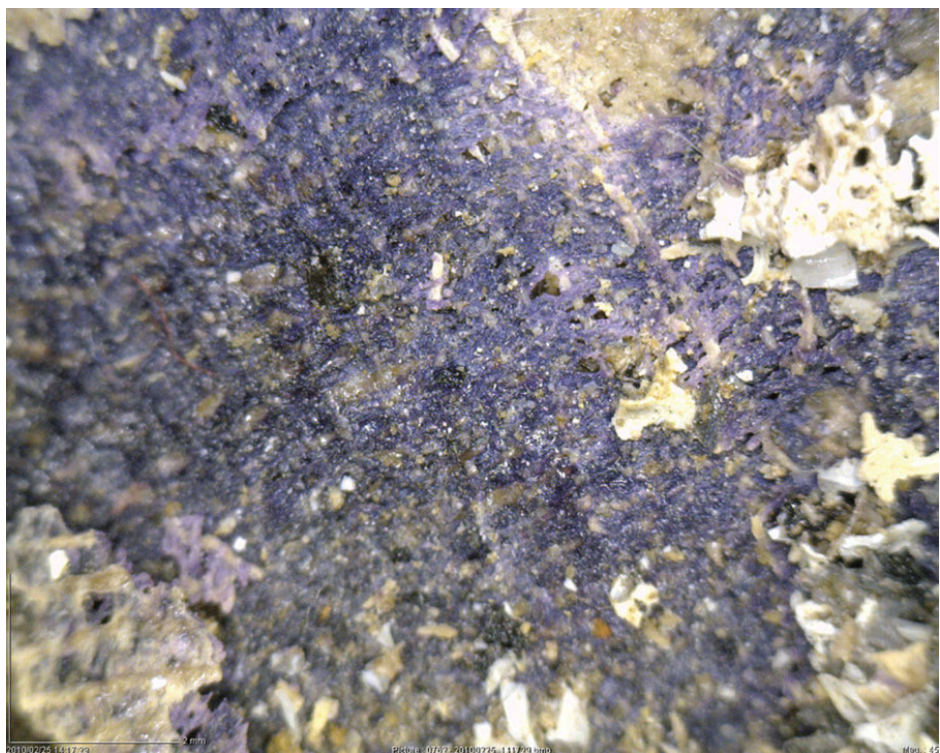


Fig. 14.4. Textile fragment with dye traces from Tomb 24, Strozacapponi-Corciano (photo: M. Gleba).

Finally, the last sample derives from the travertine urn in Tomb 27 (Corciano), which contained heavily mineralised textile remains of indiscernible structure but exhibiting very light purple traces.

All the textiles found at Strozacapponi are completely mineralised, likely due to the saturation of the originally organic matter with dissolved calcium salts from the travertine urns in which they were deposited as part of burial ritual. Scanning Electron Microscopy elemental analysis (SEM/EDS) showed that the mineralised textiles were composed of either calcium sulphate (gypsum) or calcium carbonate. The mechanism of preservation is unknown but there can be little doubt that the preservation of dyes is due to the mineralisation process. The shellfish purple-dyed Bronze Age textiles from Qatna, Syria were preserved in a similar manner.¹⁹

The four samples containing purple colour traces come from textiles that appear to have been folded and placed in the travertine urns and a ceramic vessel. The cremated remains of the deceased were either placed on the folded textile or wrapped in it. Because of heavy mineralisation, it is difficult to surmise whether these textiles were originally garments, shrouds or pieces of cloth made specifically for the funerary ritual.



Fig. 14.5. Close-up of textile fragment from Tomb 24, Stroz Zacapponi-Corciano with white warp and purple weft threads (photo: M. Gleba).

True and adulterated purple

The biological dye sources of the remaining dye constituents in the samples are identified by multi-component analyses using chromatography (HPLC-DAD).²⁰ In the light purple shaded sample from Tomb 29 (Perugia) two unknown red colouring compounds were detected but the specific dye source could not be identified. Different dye sources were used in the past for the production of purple colour, shellfish purple dye or true purple being the most esteemed. Because of the value of true purple, it was frequently imitated using other dye sources, for example the combination of red dye from the roots of wild madder (*Rubia peregrina*) or another species belonging to the Rubiaceae family, and blue dye derived from the woad plant (*Isatis tinctoria*), or by using lichens.²¹ However, shellfish purple dyeing or the more economic two step madder/woad dyeing can be excluded in the case of sample 1.

The other three purple samples were dyed with shellfish purple dye, identified by the presence of its brominated marker compounds.²² The colour obtained by shellfish purple dyeing may vary from the more reddish and violet shades to more purple and deep blue colours. The most popular shade likely changed with fashion of the time.²³ The more bluish colour of samples 3 and 4 relative to the more purple shade of the sample 2 may be due to the higher

relative proportion of the blue components compared to the more reddish ones.

Our discovery of shellfish purple dye in not one but at least three burials at Strozacaponi poses an important question: How did purple-dyed textiles come to be present in the burials supposedly associated with travertine quarry workers? The finest purple-dyed textile, in fact, comes from a rather humble ceramic vessel, whereas adulterated purple was found in the richest tomb. Is it possible that the status of people buried at Strozacaponi was not as low as previously postulated? Or was the access to purple-dyed textiles wider than we have been assuming till now?

Shellfish purple for the masses?

At the Roman military fortress Didymoi, located in the Eastern desert of Egypt and dated to the 1st century AD, numerous textile fragments with purple ground or tapestry decorations in a variety of purple shades were excavated from the rubbish heaps. More than 17% of samples analysed (11 out of 62) tested positive for shellfish purple dye.²⁴ While some of the textiles were recycled, ending up in their final resting place after being reused as pillow stuffing,²⁵ the fact that shellfish purple dye was identified exclusively in the weft of garment ornaments such as *clavi* indicates that small quantities of purple-dyed wool could suffice for the purpose. The papyrological evidence from Roman Egypt includes mentions of weights of purple wool ordered for specific garments. When this information is reconciled with the calculations of purple wool yarn needed to weave the specific ornaments, the estimates suggest that the quantities mentioned in the papyri are not only sufficient but even too high for the purpose.²⁶ This indicates that low-rank officers and even soldiers in such a far-off place had access to and could afford to use shellfish purple dye in their garments.

The textiles deposited in the burials at Strozacaponi were not dyed purple in their entirety but included small, possibly in-woven, purple decorative elements. In the case of the textile from Tomb 24 (Corciano) we can definitely say that only one thread system was purple (likely weft). Garments with purple decorative elements are well known from contemporaneous Etruscan iconography. For example, the images of the women of the Seianti family from the 2nd century BC Chiusi, a site not very far from and with strong ties with Perugia, exhibit purple stripes and decorations on dress and particularly the veil.²⁷ It is possible that some of the textiles in our study were such garments. They, too, would have required only small quantities of purple wool, explaining how the quarry workers could afford it for the textiles that accompanied them into the afterlife.

More perplexing is the presence of the adulterated purple in the richest of the Strozacaponi tombs. It is doubtful that this obviously affluent family could not afford the true purple. More likely, given the popularity of purple

colour and the variety of shades available, it was not always easy to distinguish between the real shellfish purple dye and its adulterated version. Adulteration of shellfish purple dye is well known from Roman written and archaeological sources. Thus, only one out of 17 almost complete analysed Roman tunics and dalmatics decorated with purple elements were dyed with shellfish purple dye; the rest were coloured using red madder and blue indigoid dyes.²⁸

Certainly, completely purple-dyed textiles would have been extremely expensive, but small quantities of thin purple yarn could go a long way to satisfy what Pliny the Elder called the “mad lust” for purple.²⁹

Technical note

Technical protocol HPLC-DAD analyses

Archaeological textile samples are analysed with HPLC-DAD after extraction of the dyes with a solution of 250 µl of water/methanol/37% hydrochloric acid (1/1/2, v/v/v) for 10 minutes at 105°C. After cooling down, 500 µl ethyl acetate is added, the upper phase of this solution decanted, and the ethyl acetate solution dried in a vacuum evaporator. The dry residues are taken up in 50 µL methanol/water (1/1, v/v) of which 20 µL is injected. For samples with indication of indigoid dyes, a second analysis is performed if sample size allows, after extraction in 250 µL of hot dimethyl formamide (DMF) for 10 minutes at 140°C, after which 20 µL of that extract is injected immediately for chromatographic analysis.

The HPLC system uses a temperature controlled RP-C18 column (5µm particle size, 150 × 4.6 mm) as stationary phase while the mobile phase consists of methanol (A), methanol/water (1/9, v/v) (B) and a diluted phosphoric acid solution (C), applied according to the following gradient: 0–3 minutes: isocratic 23A/67B/10C, 3–29 minutes: linear gradient to 90A/0B/10C, 30–35 minutes: isocratic 23A/67B/10C. Eluting compounds are characterised by their UV-Visible absorbance spectra measured by the diode array detection (DAD) system. Semi-quantitative evaluation of the identified dye compounds (Table 14.1) is performed by calculation of the relative proportions of the compounds in percentages after integration of the peak areas of the compounds at 288 nm wavelength.

Discussion of dye compound identification

Sample 1 (Tomb n. 29, urn 5) is a heterogeneous fragment with light purple coloured areas (Fig. 14.1). HPLC analysis of the DMF extract did not reveal any dye compound. Acidic extraction with additional ethyl acetate step (HCl/ethyl acetate) allowed the detection of two small peaks of organic compounds with absorbance maxima in the visible area at 500 nm. No match was found with any of the UV-visible absorbance spectra from known dye compounds in the in-

house reference library. The use of shellfish or madder and woad dyeing was excluded. Micro Raman spectroscopy also verified that the pink colour does not originate from inorganic red pigments such as iron oxides (red ochre from haematite ores) or mercuric sulphide (cinnabar).

The second sample (Tomb n.10, urn 4) comes from a heavily calcified block with purple layers (Fig. 14.2). The block seems to be completely mineralised and it is unlikely that any organic substance survived. Both analyses of the HCl/ethyl acetate and the DMF extract of the sample resulted in the detection of 6-monobromoindigotin (MBI) and 6,6'-dibromoindigotin (DBI) as the major dye compounds, together with a minor amount of 6-monobromoisatin (MBIS), a precursor of dibrominated indirubin (Fig. 14.6).³⁰ These brominated dye constituents are clear markers for the use of shellfish purple.³¹ In neither of the two extracts indigotin (IND) was detected. Comparison of the results of both analyses of the same sample (Table 14.1) indicates that DMF is a better extract for 6,6'-dibromoindigotin (DBI), however shellfish purple may also be identified by analysing the HCl/Ethyl acetate extract, the latter having the advantage that also mordant dyes might be detected in the same analysis.

Brominated compounds were also identified in the more bluish coloured Samples 3 (Tomb 24) and 4 (Tomb 27), the latter again heavily calcified (Figs 14.3–14.4). In the HCl/ethyl acetate extract of Sample 3 indigotin (IND) was the major compound although present in combination with minor amounts of 6-monobromoindigotin (MBI) and 6-monobromoisatin (MBIS). No compounds were found in the DMF extract of the remaining sample but this must be related to the insufficient sample size.

The same compounds were detected in the HCl/ethyl acetate extract of the calcified Sample 4: primarily 6-monobromoindigotin (MBI) is present together with indigotin (IND) and 6-monobromoisatin (MBIS). The DMF extract only contained the brominated isatin compound (MBIS).

Table 14.1. HPLC-analysis. Dye composition of true purple samples from Perugia and Corciano.

True purple samples	IS	MBIS	IND	INR	MBI	DBI	MBIR	DBIR	Extract
Tomb 10 (Perugia): purple	0	15	0	0	58	27	0	0	HCl/Etac.
Tomb 10 (Perugia): purple	0	6	0	0	47	47	0	0	DMF
Tomb 24 (Corciano): blue	0	12	69	0	19	0	0	0	HCl/Etac.
Tomb 24 (Corciano): blue	–	–	–	–	–	–	–	–	DMF
Tomb 27 (Corciano): blue	0	20	20	0	60	0	0	0	HCl/Etac.
Tomb 27 (Corciano): blue	0	100	0	0	0	0	0	0	DMF

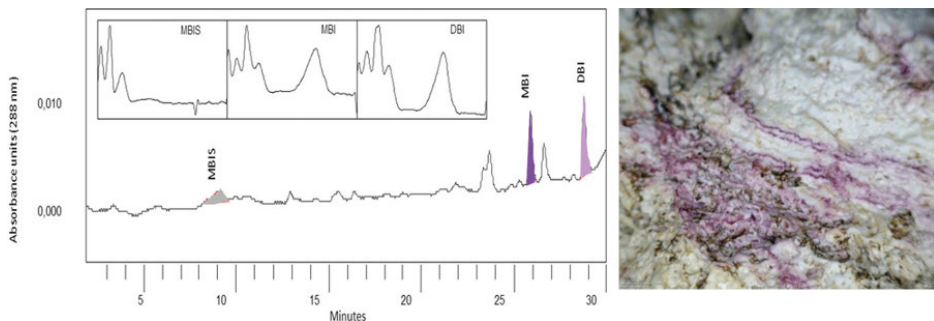


Fig. 14.6. Mono- and dibrominated dye compounds from the purple coloured layers of sample 2 (Tomb 10, Perugia). HPLC-DAD chromatogram of DMF extract (photo: I. Vanden Berghe).

Samples 2–4 are dyed with shellfish purple dye. The actual colour difference between the light purple sample 2 and the more bluish samples 3 and 4 is related to the dye composition. The high relative proportion of dibromindigotin and the complete lack of the blue compound indigotin in sample 2 account for the lighter purple shade, while the presence of significant amount of indigotin resulted in the blue shade of samples 3 and 4.

The dye composition found in samples 3 and 4 may be interpreted as characteristic for the use of the *Hexaplex*, while the complete absence of indigotin in the light purple sample 2 makes the use of this species less likely.³² Possibly *Bolinus* or *Stramonita* or a combination of different species was used to obtain a specific shade.

However, species identification based on the remaining dye components remains hypothetical. Recent studies demonstrated that the final colour of purple dye may be strongly influenced by the irradiation conditions during dye production.³³ Moreover, the burial conditions may also influence the degradation of dye constituents. The preservation of the dye compounds in the samples from Strozacaponi clearly indicates that the process of textile calcification which preserved them is also conducive to dye preservation, similar to what was found in the case of the shellfish purple dyed textiles from Qatna.³⁴

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We thank the Soprintendenza Archeologia, Belle Arti e Paesaggio dell'Umbria for the kind permission to sample the textiles and Federica Fico of Società Archeologica Lasa for the contextual data. Many thanks also to Marie-Christine Maquoi for her technical assistance with the analysis. The textile research was funded by the European Commission Marie Curie Intra-European Fellowship (FP7-PEOPLE-IEF-2008-236263) within the scope of project "FIBRE: Fibre in Italy Before Roman Empire". The dye analyses were done in the context of the EC project "DressID: Clothing and Identities. New perspectives on textiles in the Roman Empire", funded under the Culture Programme.

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16 Cenciaioli 2004; 2010.

17 Cenciaioli 2010.

18 Gleba 2008.

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20 See below, Technical Note.

21 Wouters *et al.* 2008; De Moor *et al.* 2010, 44.

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23 See Meiers in this volume.

24 Cardon *et al.* 2011, 200.

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27 Swaddling and Prag 2002.

- 28 Wouters *et al* . 2008; De Moor *et al* . 2010.
- 29 Plin., *HN* IX, 127.
- 30 Cooksey 2001.
- 31 Wouters 1992; Cooksey 2001; Koren 2008.
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- 34 James *et al* . 2009.

Historical outline and chromatic properties of *purpura rubra Tarentina* and its potential identification with purple dye extracted from *Bolinus brandaris*

Fabienne Meiers

Introduction

The following manuscript was produced as a preliminary study for an ongoing series of experiments to determine the chromatic properties of purple dyes and to reconstruct a variety of purple tones mentioned in antique written documents. The aim is to develop an extensive colour display of various types of purple molluscs with regard to the respective historical colour designation and fashion trends, as well as to consequently provide reference material for future comparative studies.

In the past few years, scientific tests have primarily been carried out with the more colour yielding type *Hexaplex trunculus*, while the ancient testimonies clearly describe the use of spiny-dye murices as well.¹ In this paper, the emphasis lies therefore on the practicability of ancient dyeing techniques using *Bolinus brandaris* and the colour obtained in this manner.

Historical outline of Tarentine Red. Written evidence: the fame of red purple

*“Quid placet ergo? Lana Tarentino violas imitate veneno.”*²

The first textual evidence in Latin for a violet dye from Taranto was recorded by the Roman poet Horace (65–8 BC) and dates back to the end of the 1st century BC. Although there is no direct indication that a mollusc dye was meant, this can nevertheless be assumed with regard to the implied high value of the wool. The qualification *rubra Tarentina* is first found in the *Historia Naturalis* written by Pliny the Elder in the 1st century AD.³ It includes a quotation of Cornelius Nepos, a Roman historian and biographer born around 100 BC, so this reference is in fact older than the one seen above, in which he says:

*“[...] iuvene violacea purpura vigeat [...] nec multo post rubra Tarentina, huic successit dibapha Tyria [...]”*⁴

Obviously, the younger violet purple dye from Taranto mentioned by Horace was not identical with the red purple found in Cornelius Nepos' statement.⁵

Taking the birth date of Cornelius Nepos into consideration, an approximate classification of the purple-colour fashion vogues is possible: violet purple was popular from c. 100 to 75 BC, red Tarentine purple from 75 to 50 BC and double-dyed Tyrian Purple from 50 BC onwards; according to Horace, towards the end of the 1st millennium BC, violet purple from Taranto was fashionable.⁶ The timespan from 75–50 BC, when *rubra Tarentina* was in vogue in Upper Italy, squares perfectly with the fusion of the Roman colony of Neptunia (founded in 123/122 BC) with the Roman *municipium* in Taranto some time after its foundation in 90/89 BC.⁷ This unitary administrative body gathered the local community of Greek descent, Italic and Roman settlers. And by this means, red purple dye from Taranto could be widely propagated in the Roman world.⁸

Even though this historical date seems to impose a precise reference, purple-dye production in Taranto not only started with the Roman period, but it can be traced back to the Hellenistic period. In her lecture given at the workshop in Lecce, Cecilie Brøns demonstrated that purple-dyed garments from Taranto could be found in Greek temple inventory lists and had possibly been used to dress votive statues (see this volume). We will see to what extent this fact can be corroborated with regard to numismatic and archaeological evidence.

Archaeological and numismatic evidence: purple dye-production in Taranto

Taranto, the “city of the two seas”, is situated in a strategically favourable location also known for its abundance of natural resources; a commercial port was located in the bay called Mar Grande, which is protected by two islets. Another inner saltwater bay with a perimeter of c. 25 km, called Mar Piccolo, is formed by the peninsula of the old city.⁹ This bay was and is still used as a fishing ground (especially for cultivating shellfish) and as a military harbour with strategic importance.¹⁰ Throughout history, the fishing industry was a central pillar of economic success and wealth of the city.¹¹

The history of Taranto begins in the 8th century BC, when the city, known in Greek as *Τάρας* and in Latin as *Tarentum*, was founded as a colony by Dorian immigrants.¹² In the 5th and 4th centuries BC, at the peak of its power and wealth, Taranto issued its own coins like many Greek city-states.¹³ One type of didrachm presents the symbols of the city: on the averse the mythological founder Taras, who was saved during a shipwreck by a dolphin sent to him by his father Poseidon, and on the reverse a figure sitting on a *diphros* and holding a spindle or a distaff (Fig. 15.1).¹⁴ This may stand for the highly valued fine-wool production in Taranto and the resulting economic strength.¹⁵ When taking a closer look at the coin a shell can be seen depicted underneath the dolphin. This shell has a long siphonal canal and a rounded body whirl with a low spire. There are also rows of spines discernible, which makes it evident that the displayed shell can be identified as *Bolinus brandaris*, also called spiny dye-

murex. This is a clear indication of the significance of purple-dye production in Taranto.¹⁶



Fig. 15.1. Greek didrachm (νομός) from Taranto with purple shell on the avers. Mid-5th century BC. Cf. Ravel (1947), 206.

Besides textual and numismatic evidence, there is further evidence from archaeology. According to accounts from the 18th and 19th century, at Monte Testaceo (also known as Monte Coccioli), which now lies within the boundaries of the National Archaeological Museum (MARTA), there were shell middens consisting mainly of spiny dye-murices.¹⁷ Fragmentary shells delivering building lime were also used to construct the city's walls; they gave it a characteristic structure. The coastal line of the Mar Piccolo was lined with piles of broken shells from antiquity as well.¹⁸ This is a striking sign for the abundance of purple-dye workshops in and around Taranto.¹⁹ The predominance of *Bolinus brandaris* also confirms a specialized manufacturing of *purpura rubra*.²⁰



Fig. 15.2. Fragmentary white-ground kylix from Taranto showing a maenad and a satyr dressed in purple, painted by the Pistoxenos Painter. Early mid-5th century (Simon 1976, table xli).

Apart from broken shells, Hellenistic terracottae found in the necropolis of the city reflect the importance of red purple-dye industries in Taranto.²¹ A fragmentary kylix dated to the early mid-5th century BC depicts a satyr, who is grasping a maenad; the chiton she wears has a dusky pink colour – maybe red purple (Fig. 15.2)?²² The MARTA's collection includes a polychrome female figurine wearing a cloth-band around her hair and a golden diadem on her head; she is also draped in a pink himation (Fig. 15.3). This figurine has been dated to the 2nd century BC. Further female figurines from the collection of the museum are also dressed in chitones or himatia with pink, sometimes also bluish rose or pale lavender borders in case the garments are not completely pink or lavender (Fig. 15.4).²³ Is it mere coincidence, that votive figurines found in Tarentine grave inventories so frequently display a distinctive old rose hue? Could this colour in fact be *purpura rubra Tarentina*?²⁴



Fig. 15.3. Polychrome female votive figurine with pink himation from the necropolis of Taranto. 2nd century BC (photo: A. de Luca).



Fig. 15.4. Polychrome female votive figurine from Taranto holding a folding mirror and wearing purple garments. 3rd-2nd century BC (Bildagentur für Kunst, Kultur und Geschichte, Stiftung Preußischer Kulturbesitz, Berlin, Antikensammlung, Staatliche Museen zu Berlin; photo: J. Laurentius).

Looking for *rubra Tarentina*. The use of *Bolinus brandaris* and its vat

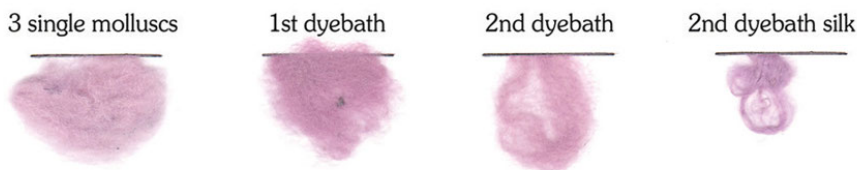
We have already discovered through historical evidence, that a special red purple dye existed between c. 75 and 50 BC, called *rubra Tarentina*. We also have archaeological evidence that purple-dye workshops were present in Taranto in antiquity. We know which muricides were mainly used in Tarentine

purple-dye production. And we know the recipes to reproduce purple-dye vats based on the accounts of Pliny the Elder. So what exactly could have been the colour of *rubra Tarentina*?

In accordance with the sources mentioned above, the possibility was addressed, that Tarentine Red might be reproduced in an experimental approach by using hypobranchial glands primarily from spiny dye-murices. Different kinds of vats, both historical and modern, were tested. The historical vat was based on the accounts of Pliny the Elder,²⁵ and on former experimentation notably by Edmonds, Boesken-Kanold and Haubrichs, Koren and Ruscillo.²⁶ To set the modern synthetic vat, instructions from recent chemical science articles were used.²⁷ The reductive agent in the modern vat was in most of the cases sodium dithionite ($\text{Na}_2\text{S}_2\text{O}_4$) in the presence of sodium hydroxide (NaOH); the exact procedures will not be described further in this paper, as they have already been explained in detail in other articles.²⁸

To start the historical fermentation vat, first 2 kg of fresh spiny-dye murices were crushed in a mortar and the hypobranchial glands were extracted with the help of tweezers. The average time for cutting out the glands was three snails per minute. The cut-out glands have then been provisionally stored in a bowl and exposed to direct sunlight to help the colour develop from bright yellow over green to blue and finally violet.²⁹ One part of the extracted glands was salt-dried for storage, while the other part was immediately processed in a blender with some freshwater added.³⁰ To this mixture stale urine was added; the vat showed a pH of 8.7. It was then heated to a temperature of 50°C and stored at room temperature with a lid put onto the vessel to prevent oxygen from getting into it. After a week, the first wool sample of 0.1 g was put into the mixture and steeped for 24 hours. Unfortunately, it had not taken as much colour as expected: it only showed a very pale pastel pink. So the vat was filled up with the residues from a 3-month-old vat containing *Bolinus brandaris*.³¹ Again this vat rested for 1 week during which no heating occurred; the colour changed to a dull gray.³² Again, the samples were put into the vat for 24 hours. When they were removed, there first was a coat of gray, but underneath a dark-yellow appeared, which would turn to a dusky pink after getting in contact with oxygen (Fig. 15.5, a). All procedures were executed in the absence of UV-light.³³

a) Dyes in *Bolinus brandaris*



b) 2:1.11 mixture of *Bolinus brandaris* and *Hexaplex trunculus*

- UV-radiation during reduction process



c) Dyes in *Hexaplex trunculus*

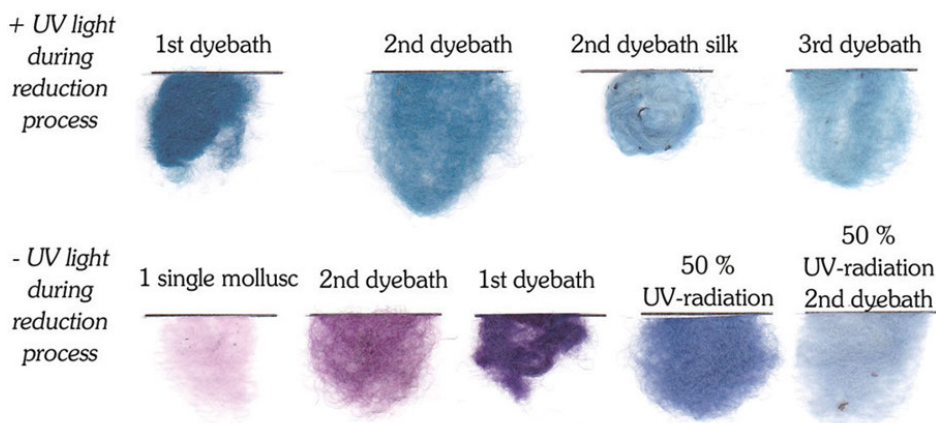


Fig. 15.5. Colour samples from the experimental series.

The chromatic range of purple dyes from *Bolinus brandaris*

The colours extracted from the glands of the spiny-dye murex vary between pastel pink and antique pink, on silk a slightly bluer tint is visible. In summary, the colour samples are relatively pale in comparison to those dyed with *Hexaplex trunculus* (Fig. 15.5, c).³⁴

The specific colours originate from the chemical dye composition in the molluscs: in *Bolinus brandaris* 6,6'dibromoindigotine dominates with 81%. A further 6% are 6-bromo indigotin and 13% 6,6'dibromo indirubin.³⁵ Whereas in *Hexaplex trunculus* indigo prevails with 53% in the dye composition; 33% are 6-bromo indigotin and 14% indirubin.³⁶ Indirubin is insoluble in water, just like

indigo, but it is not as lightfast.³⁷ To enhance the fastness of the dye from spiny-dye murices, Pliny had already proposed to add *Hexaplex trunculus* to the vat.³⁸

As mentioned previously, the middens of crushed shells in Taranto contained more shells from *Bolinus brandaris* than from *Hexaplex trunculus*. So another experimental approach was taken to see how the two vats from spiny dye-murices and banded dye-murices reacted when mixed together, and to determine which colour could be obtained. A ratio of 2:1.11 to get the colour *amethysta* was recorded by Pliny.³⁹ For Tarentine Red, however, if it ever was realised by mixture, the ratio remains unknown.⁴⁰ The ratio of 2:1.11 can be explained by the fact, that twice as many specimen of *Bolinus brandaris* than *Hexaplex trunculus* are needed to get decent results in dyeing wool; the glands of the former species contain on average 0.6 mg of dyeing substance whereas the glands of the latter contain 1.2 mg.⁴¹ Due to the addition of *Hexaplex trunculus*, the dye deepens from dusty pink to salmon pink (Fig. 5, b). It still has to be observed, if the achieved colour is actually light faster than the initial dye.

One further comment on the colour feature: in spite of its paleness, the pastel rose obtained from *Bolinus brandaris* was much admired in antiquity as well as the pale colour of conchyliated dresses (*conchyliatae vestes*) made without *bucinum*, but possibly mimicking the pale red from Taranto.⁴² The Late Roman papyri Holmiensis and Leidensis also contain recipes to imitate this special shade.⁴³ Furthermore, in the “Edict on Maximum Prices” issued in AD 301 by the Roman Emperor Diocletian, *purpura hypoblatta* (a bright red purple mixture) is priced higher than *oxyblatta* (deep red purple achieved with kermes), but lower than *blatta* (double-dyed Tyrian Purple).⁴⁴

Conclusion

Textual, numismatic and archaeological evidence indicate the presence of a large purple-dye manufacture in Taranto since the 5th century BC.⁴⁵ *Tapac/Tarentum* was a very productive city during the Hellenistic and Roman Age, not only specialized in textile luxury products, such as fine wool for nearly transparent garments and maybe gold threads and sea-silk as well, but also in the manufacture of an exclusive red purple hue obtained by either dyeing solely with spiny-dye murices or – when mixed together – with larger quantities of *Bolinus brandaris* than *Hexaplex trunculus*.⁴⁶

In the course of experimentations, it could be determined that *Bolinus* chiefly produces dusky pinks on wool and soft red-violets on silk, whereas *Hexaplex* produces a wider colour range with shades of lavender, red-violet and blue-violet, turquoise, petrol and midnight blue depending on the amount of UV-light during the reduction process. Mixtures of different murex species or over-dyeings were frequently used in antiquity to obtain certain shades of colour

(like double-dyed Tyrian Purple) or to reinforce the colour-fastness as is possibly the case with *rubra Tarentina*. This makes it difficult in textile dye analyses to determine which muricides were used and in which relative quantity, even when the dye composition can be decoded.

In difference to today's colours' preferences tending towards more saturated hues in terms of value and attractiveness, this was not the case in antiquity. The pale rose obtained from *Bolinus brandaris* was very prestigious as has been demonstrated above. As more material is needed to obtain a decent shade together with more labour, the final product also becomes more expensive and exclusive. Red purple from Taranto was not merely a geographical designation for a certain hue of purple among many others. *Purpura rubra Tarentina* was rather a kind of luxury label, like Tarentine wool or Tarentine horses, and used as a status symbol in the Greek and Roman world.

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1 Cf. Elsner and Spanier 1985, 1–24; Cooksey 2001, 740–741.

2 "What pleases then? The wool, which imitates the violet with Tarentine dye." Or in a wider sense: "The woollen garment dyed with the purple of Taranto." Hor., Ep. II, 1, 207. Reference taken from Wilkins 1888, 50.

3 All references to Pliny's *Natural History* have been taken from Rackham 1940.

4 "[...] in my young days the violet purple was in vogue [...] and not much later the red purple of Taranto. This was followed by the double-dyed Tyrian Purple [...]", Plin., *HN* IX, 137.

5 Identifying Roman botanical name attributions can be very problematic. Thus *viola* cannot certainly be assigned to the violet known today. von Martens 1874, 12 proposed several possibilities.

6 Cf. also Steigerwald 1990, 244–245.

7 Lenormant 1881, 64–65; De Juliis 2000, 34, 70–71.

8 Naturally, this propagation into the northern parts of the Republic took some time. By the 5th century AD at latest, the dye works of Taranto were under imperial control, cf. Gossen and Steier 1921, 613 and Macheboeuf 2008, 28.

9 Lenormant 1881, 12–13; De Juliis 2000, 52–54.

10 Lenormant 1881, 13–14; De Juliis 2000, 15–16.

11 Lenormant 1881, 14; De Juliis 2000, 81.

12 von Martens 1874, 5; Lenormant 1881, 21–23; De Juliis 2000, 9.

13 De Juliis 2000, 24–30, 35–36.

14 Ravel 1947, 206; De Juliis 2000, 12–13.

15 Morel 1978, *passim* ; De Juliis 2000, 81; Gleba 2008, 194, 197. The latter emphasises the presence of a textile/clothing market located in the agora.

16 Lenormant 1881, 14; Macheboeuf 2008, 28–29; Gleba 2008, 80–81, 197. Macheboeuf 2008, 27 points out that in Satyrion, a neighbouring city of Taranto, purple could have been produced as well according to sources from Roman literature.

17 Reese 2005, 111; Gleba 2008, 156. Steigerwald 1986, 6 n. 52, 18 and von Martens 1874, 50 n. 15, however, remark, that only shells from spiny dye-murices could be found in Taranto.

18 Lenormant 1881, 107; Evans 1886, 6–7. The latter points out the equal presence of the two species *Hexaplex trunculus* and *Bolinus brandaris* in situ. He also mentions remains of dye-workshops still visible in the 19th century with fragmentary wall plaster showing traces of purple colour. Cf. also von Riedesel 1771, 206–207.

19 Lenormant 1881, 107; De Juliis 2000, 61, 81; Reese 2005, 110–111; Gleba 2008, 80–81. Evans 1886, 7 also makes reference to a gold ring engraved with a purple shell found in an archaeological site at Taranto. He assumes it belonged to a supervisor of the purple industry in Taranto.

20 Steigerwald 1986, 16–18. Unfortunately, it is hardly possible to date heaps of broken shells. Nonetheless, it seems as if the middens found in the centre of the town are older than those found along the coastal line of the Mar Piccolo. This observation coincides with the purple colour fashions.

21 De Juliis 2000, 86–104. Margarita Gleba and Ina Vanden Berghe demonstrated in their lecture given at the workshop in Lecce that tombs at the Hellenistic necropolis of Stroz Zacapponi dating to the 3rd–1st century BC also enclosed textiles dyed with shellfish purple.

22 Curiously, the satyr wears a dark violet skin pelt. Could there be a gender issue or a symbolic attribution in wearing either red or blue purple?

23 Terracotta figurines from Tanagra (Greece) are also dressed in pink garments. Cf. De Juliis 2000, 101–102.

24 Unfortunately, no dyestuff analyses of the earthenware exist so far, but it would be very interesting to see, if real mollusc purple, a kind of *purpurissum*, was used in the paintings. According to Antonacci Sanpaolo *et al.* 1990, 145–147, analyses of polychrome terracottae from Mattinata (Apulia) confirmed the presence of shell purple dye in the pink paint. The authors also assume the fabrication of *purpurissum* in Taranto. Cf. also Haubrichs 2004, 146–147.

25 Plin., *HN* IX, 125–141.

26 Edmonds 2000; Haubrichs 2004; Boesken Kanold 2005; Koren 2005; Ruscillo 2005; Boesken Kanold and Haubrichs 2008. Elsner 1991, 13 proposes for S-type molluscs (secreting only substituted indoxyls), such as *Bolinus*

brandaris and *Thais haemastoma* , a direct dye by interrupting the enzymatic, oxidative and photochemical reaction with an acid dye bath. The colour outcomes are, however, less fast. Cf. also McGovern and Michel 1987, 140–143 and McGovern and Michel 1990, 98 concerning this issue.

27 Elsner and Spanier 1985; McGovern and Michel 1990; Elsner 1991; Verhecken 1994; Cooksey 1995; 2001. The modern vat using sodium dithionite reduces the time of reduction to less than 1 hour.

28 Cf. n. 27. A detailed description of starting purple dye vats by fermentation and by chemicals can be found in Meiers 2013, 46–51.

29 One of the oldest descriptions of this chromatic transformation dating back to the 17th century can be found in Dedekind 1898, 56–57.

30 Cf. Steigerwald 1986, 12–13 n. 86, 21; Boesken Kanold 2005, 151–152; Gleba 2008, 155 for more information on this method of storing the glands.

31 Boesken Kanold 2005, 151–152. It could be observed in further experimentations, that time is an essential factor in reducing the dye from spiny dye-murices, cf. also Verhecken 1994, 34. The older the vat, the better it dyes. This empirical observation could be an interesting approach for ensuing scientific analyses.

32 Verhecken 1994, 34.

33 UV-light might have radically modified the chemical dye composition in *Hexaplex trunculus* and consequently the final colour of the samples would have tended towards a more violet shade. Unfortunately, the historical sources are not very precise on this issue.

34 Plin., *HN IX*, 126 compares the dye of the *purpura* with a dark (wild) rose (*nigrantis rosae colore*). For more colour samples of red purple producing molluscs cf. de Lacaze-Duthiers 1860, 71, 83; Verhecken 1990, 33. Many of the colour samples shown in this paper stem from former experiments, cf. Meiers 2013, *passim* .

35 Cardon 2007, 557. Cf. also the results of Cooksey 2001, 751.

36 Steigerwald 1986, 10; Cooksey 2001, 751; Gleba 2008, 80. In addition, the influence of harvest time, natural habitat, sex and freshness on dyes extracted from molluscs can be very prominent, cf. Steigerwald 1986, 19.

37 Fouquet and Bielig 1971, *passim* ; Steigerwald 1986, 11, 16–18.

38 Plin., *HN IX*, 134.

39 Plin., *HN IX*, 135. Steigerwald 1986, 21, 55; 1990, 239–240 precises, that *amethysta* refers to the Indian amethyst, which has a redder tint changing from the colour of red wine to violet.

40 Lenormant 1881, 107. Steigerwald 1986, 18, however, argues against this hypothesis: in contrast to the dye of *dialutense* (*Bolinus brandaris*), the dye of *bucinum* (*Thais haemastoma*) could be used alone, because it was more

lightfast. The light fastness of both species still has to be analysed and compared.

41 Reese 2005, 110 referencing Elsner and Spanier 1985, 124–125. Two parts of *bucinum* to 1.11 parts of *pelagium* . Most of the modern researchers have identified *bucinum* with *Thais haemastoma* , thus a red colour producing shellfish like *Bolinus brandaris* , cf. Verhecken 1990, 34; Steigerwald 1986, *passim* ; Macheboeuf 2008, 249.

42 Cf. Steigerwald 1986, 24–35 for a detailed interpretation of conchyliated dyes. Considering the modern identification of *bucinum* , conchyliated dresses were only dyed with *Hexaplex trunculus* (*pelagium*) in small quantities and with human urine added as mentioned by Plin., *HN* IX, 138. Textiles dyed in this way seem to have been much more affordable: less material was needed, therefore also fewer workforces. In addition, *pelagia* were much cheaper on the market than *bucina* , cf. Plin., *HN* IX, 138.

43 See also Meiers 2013, 53–56. The reconstruction of recipe nr. 95 from the papyrus Leidensis gave a brilliant pink very similar to the nuance achieved with glands from spiny-dye murices.

44 Steigerwald 1990, *passim* . He identifies *hypoblatta* with Pliny's *amethysta* .

45 Cf. also Reese 2005, 111.

46 De Juliis 2000, 81–145. Cf. Gleba 2008, 82 and 197 for the hypothesis on gold-thread production in Taranto. Lenormant 1881, 14–15: while purple dye production had ceased before the 19th century, the manufacturing of *Pinna nobilis* still continued.

“Purple Wars”: fishing rights and political conflicts concerning the production of marine dyes in Hellenistic Greece

Carmen Alfaro Giner and Francisco Javier Fernández Nieto

Introduction

Since ancient times, the Eastern Mediterranean sea constituted a place for communication but at the same time for confrontations among coastal peoples.¹ Fishing, along with agriculture and animal husbandry, was one of the most developed means of living.² In the Greece of the *poleis* many people lived off of the sea. Therefore, it was necessary to guarantee the free exercise of this trade, but within legal frameworks that permitted coexistence to be as peaceful as possible when conflicts arose.

On the other hand, we need to keep in mind that fishing in general was greatly developed not only among coastal populations but also in agro-pastoral territories in the interior, whose inhabitants needed this source of food and wealth. In some cases we will see how certain *poleis* tried to control marine riches like purple dye. One could even say that the wealth generated by the commercialisation of shellfish purple came to be one of the incentives for the creation of certain settlements in the western Mediterranean, as seems to be the case with Ibiza (Alfaro and Mylona with bibliography).

The range of interests in the fishing varieties was very wide. Among them, one stands out from ancient times: fishing for *muricidae* (*Hexaplex trunculus* L., *Bolinus brandaris* L. and *Purpura haemastoma* L.), from which the Mediterranean purple dye was produced.³ We know its use through written sources (Aristotle, Oppianus, Aelianus, Pollux and Pliny, especially), through the faunal remains or shell middens on the Eastern Mediterranean coasts,⁴ and even through the analysis of a few, but important, textile remains that date back to the Creto-Mycenaean period. However, we do not have specific data on fishing rights, and therefore on a legal framework that regulated the fishing for these and other sea animals, until the Classical, and especially, Hellenistic periods. The development of the *poleis* world lets us see the complexity of populations' forms of cohabitation, which, due to a vital economic issue, fishing, could lead to confrontations that required clear rules of action and referees who determined correct compliance with them.

Fishing for shellfish purple: environmental and political aspects

As we will see throughout the examples of agreements among *poleis* that we are going to discuss, it is evident and very interesting to see how the study of purple dye's production should not be done in isolation, but rather by focusing on a broad context that involves multiple aspects: geo-environmental, scenic and even agro-pastoral, as we are observing in our studies of Ibiza.⁵ In other words, the study of the production of purple dye cannot be seen as an isolated economic fact, but rather as forming part of an autarchic system that is partly seen in the brief texts of the treatises. A number of spots on the coastline of the *poleis* seem to have been particularly suitable for the extraction of fish as well as mollusks, dye seaweed,⁶ sponges, corals, etc. But we should not forget that these maritime territories were only a part of the total that formed a state (meadows, mountains and farmland). The importance of the coastal area depended on the presence of rich ichthyofauna,⁷ but especially on the fact that this area offered good conditions for carrying out the corresponding capture and, naturally, the marketing of the product.

Muricidae and migratory species (like the valued tuna fish, and the schools of sardines and mackerels that passed near the coast in certain seasons of the year) were the main interests. Natural seasonal staggering of the fishing work more efficiently distributed the time of local workers.

There are several factors that could make some areas richer than others in reference to the presence of *muricidae*:

- (a) the suitability of the temperature in an especially sheltered spot, ⁸
- (b) the safety of this spot compared to others that were more open and exposed to excessive currents, ⁹
- (c) the slimy bottoms, rich in certain algae, for laying eggs, ¹⁰
- (d) the presence of small ports nearby, where fishermen cleaned their nets or regularly threw away unwanted remains, consequently, baiting the area. ¹¹

But there are still other reasons that could make some places more attractive than others for the establishment of purple dye workshops. We are referring to the secondary needs in the production of the dyestuff itself (after Pliny):¹²

- (a) the presence of a nearby forest for the necessary firewood, ¹³
- (b) the existence of nearby salt ponds, due to the need to add salt (we will see some mention of this in our texts), ¹⁴
- (c) the proximity of a source of freshwater for making the dye, a necessity given that saltwater does not work for forging the cauldron used for the dye.
- (d) or some other type of incentive, such as the presence of easily obtainable lead (for making the vat), ¹⁵ etc.

The abundance of high-quality wool in agro-pastoral areas of the coast zone, or even in inland areas, was very important, as it allowed the liquid dye (very perishable) to be used as soon as possible, and to trade directly by dying the

wool with it.¹⁶ Normally the two activities are developed together (as in the case of Milet, Taranto, Syracuse, Baetica, and other famous places for wool production).

Although fishing on the open sea was a free activity, in some coastal places, observatories or lookout posts were erected to detect the arrival of the schools of fish. This is what the texts called σκοπιά, θυννοσκοπεῖον, ἡμεροσκοπεῖον.¹⁷ There used to be small fishing ports (λιμένα), too, which facilitated all these tasks.¹⁸ In Greece, ownership of the observatories and the small ports belonged to the state (the *polis*). Often, the *polis* could lease these places to “fishing societies”. The lease gave these societies the exclusive right to fish from those maritime spots. The state-owned fishing observatories and the *limenia*, or small ports were situated all along the Greek coast, as evidenced by several inscriptions from the Hellenistic period, as we shall see. We know of them thanks to arbitration decisions handed down to resolve territorial disputes between *poleis* that fought for control of these fisheries. In addition, we must not forget that some of these places were subject to a system of joint ownership and common use between two or more cities. This form of fisheries regulation was older, and goes back at least to classical times, according to inscriptions.

Some of these fisheries constituted, therefore, a marine reserve and were shared by two (or more) *poleis*. This forced the establishment of some formula for the exercise of the joint ownership. Most probably, cities would either take turns in possessing the area annually, or they would distribute the dates of fishing by months (September–November are good for *muricidae* fishing in the Eastern Mediterranean). Each *polis* seems to have leased its fishing rights separately. As state revenues generated by the activities of the observatories and fishing ports proved to be a remarkable source of wealth, the *poleis* took great care to maintain and defend these προσόδοι, which may be qualified as προσόδοι τῶν λιμένων or προσόδοι ἐκ θαλάσσης.¹⁹ This affects tuna more than murex.

This reality often caused two neighboring cities, or two cities that frequented the same areas of exploitation, to end up in confrontation due to their desire to get the highest revenues. Of course, *muricidae* was the fishing activity that probably provided the highest revenues.²⁰

We will consider several historical situations to verify how acquiring exclusive use of the best spots of exploitation in continental Greece and on the island of Crete resulted in hostile confrontations on several occasions. Such wars broke the peaceful practice of fishing for shellfish purple and resulted in specific agreements that were designed to regulate the quiet procurement of this raw material in the future.

The arrival of the Ptolemies in Egypt modifies the relations between these rich, industrialized lands and the Aegean world significantly. We know that Crete turns to Egypt and North Africa (Cyrene) precisely at this historical

moment. The profitable business was in the trade with Delta-Faiyum, a land with extensive textile production and, from the Hellenic era onwards, with a high level of wool usage, as the textile remains preserved from this period show. We should take into account that we have no information about purple dye production in the north of Egypt. It is very plausible, therefore, that there was demand for yarns dyed with marine dye-stuff for use in more valuable fabrics. The coast of the Eastern Peloponnese possessed suitable locations for the concentration of shellfish purple. This area produced the famous variety called *purpura laconica*, of great quality and unusual colours.²¹

The epigraphic sources: some examples

Arsinoë and Troezen

The first arbitration on *muricidae* fishing that we are going to discuss was carried out in the middle of the 2nd century BC by senior officials of Ptolemy VI, between ancient Methane, which changed its name to Arsinoë precisely in that period, and Troezen. The arbitration resolution shows that both cities had a common coastal territory on the Saronic Gulf (Fig. 16.1, nos 1–3) and some fisheries in a joint ownership regime.

IG IV²² 1. 76 + 77, ll. 27–29 and 38–40 (middle of the 2nd century BC):

“τὰν δὲ χώρ]αν καὶ τὰς ἀλάς καὶ τὸ λιμένιον|[...] δίδ[οσ]θαι δὲ ἐξαγωγὰν κατ’ἐνιαυ| [τὸν, - - -] ἀτελέων ἐργαζομενᾶν τᾶν ἀλᾶν.”

ll. 38–40:

“περὶ δὲ τὰς κοινᾶς χώρας καὶ περὶ]

τᾶν ἐπικαρπιᾶν| τᾶν ἐκ τᾶς χώρα[ς καὶ περὶ τᾶν ποθόδων τᾶν ἐκ θαλάσσης γ]ενομε[νᾶν]|ἐν τοῖς ἔμπροσθε[ν χρόνοις μὴ δικάσασθαι μηθένα”

“The territory, the salt ponds and the small port [...] permit the annual collection of salt without charging fees for the salt ready for use ... Regarding the common territory and the exploitation of the territory, and with respect to the revenues obtained from the sea at previous times (to this arbitration), nobody can be put on trial”.

Each *polis* obtained substantial revenue during the time it had the exploitation right. Within the territorial area under dispute, the arbitration document registers a small port or λιμένιον, which was probably used for shellfish purple fishing and dye production.

One *polis* gained exclusive control of the part of the territory that included the fisheries. At the same time, the city deprived of its status as co-owner, and, as a result, of its use and enjoyment of the marine products, was forced to resort to compensation through reprisals (surprise attacks on the fishery or the boats that collected the marine products, taking the workers at the fishery as prisoners, etc.).²²

In such cases, disputes went to arbitration. To put an end to the conflict and to past incidents, the arbitrators decided that nobody could be taken to court for claims related to revenues from fisheries. The arbitrators also set compensation for those who had suffered such reprisals.²³ Compensation came from future revenues generated by the fisheries.



Fig. 16.1. 1. Arsinöe; 2. Troezen; 3. Saronic Gulf; 4. Epidauros; 5. Hermione; 6. Vurla Bay; 7. Tenos; 8. Epidauros Limera; 9. Zarax; 10. Delos.

Epidauros and Hermione

The arbitration resolution dictated towards the end of the 3rd century BC by judges of Miletus (Fig. 16.3, no. 18) and Rhodes (Fig. 16.2, no. 12), in a territorial dispute between Epidauros and Hermione, indicates that one of the items at issue was the so-called ἄγριοι λιμένες or “wild ports” (the coast which today forms the Vurlia Bay; Fig. 16.1, nos 4–6).²⁴ This toponym is quite eloquent and reflects the existence of several fishing sites within the bay. Both cities disagree on the property and exploitation, perhaps shared. Judging by the adjective ἄγριοι, probably these were spots where fishing was especially tiring;

most likely, centered on shellfish purple obtained by traps (pound 4 nets) and diving.

Magnetto 69, I, ll.10–16:

“καὶ ἐπὶ τοὺς διαμφοισθητούμενους τό|πους ἐπελθόντες κατὰ τὴν γενομένην περιήγησιν ὑφ’ἐ|κατέρων ἐπεκρίναμεν ἐπὶ συνλύσει περὶ ἧς προεκαλέσ[α]|το χώρας ἢ πόλεις τῶν Ἑρμιονέων τὴν πόλιν τῶν Ἐπιδαυρί|ων τῆς τε κατὰ Σελλᾶντα καὶ Ἀγρίους Λιμένας ἄχρι τοῦ| Στροθοῦντος. εἶναι ταύτην κοινὴν Ἑρμιονέων καὶ Ἐπιδαυρίων,| οὕσαν τῆς Διδυμίας.”

“And having come to the places that are subject to dispute, as a result of the inspection carried out under the guidance of the parties, in order to resolve the claim over the territory that the city of Hermione presented against the city of Epidauros, we have decided the following regarding all the area located along the river Sellas and the Wild Ports up to the Strutos: that this territory, which is part of the Didymia, (hereafter) will be common to the people of Hermione and Epidauros”.

Hermione was one of the best producers of purple dye. Let us recall the well-known text by Plutarch, *Alexander* 36: between the riches found in Susa by Macedonians in the year 330, there were fabrics dyed with purple dye from Hermione that were more than 200 years old, and very well preserved. The theft, after the traditional debauchery at the Apaturian festival of Athens, of a linen napkin dyed with purple from Hermione, is narrated in detail in an unusual text which remarks on the exorbitant price of the stolen piece.²⁵ No doubt the sources were thinking of the purple dye of Hermione when they speak of the excellence of *purpura Laconia* (*supra*, note 20). We do not know the final provisions issued by the arbitrators.²⁶

Zarax and Epidauros Limera

In the first half of the 2nd century BC, judges sent from Tenos (Cyclades) performed a territorial arbitration between the cities of Zarax and Epidauros Limera (Fig. 16.1, nos 7–9). Both cities were situated in the Laconia peninsula and were rich in shellfish purple.

SEG XIII 259, ll.3–7 and 28–29 (Middle of the 2nd century BC):

ll. 3–7:

“ἀμφοισβήτη|[σιν περὶ τᾶς ἀμφιλεγομένης]ας χώρας ἀπὸ|[-----σκ]οπιᾶς τᾶς ἐπὶ τῷ|[----- καὶ τῶν ὑδάτων κα[ι]|τῶν ποτικυρόντων] ταῦται καὶ τοῦ λι[μένου]ς”

ll. 28–29:

“δεδόσθαι δὲ αὐ|τοῖς καὶ εἰς ἀνδριάντα ἢ ε[ικόνα] ἐκατέρωι ἐφ’ἡμί|σει ἀν’ἔτη δύο τὸ θαλάσσ[ιον] τέλος.”

“The dispute over the surrounding territory (extends?), from [...] the observatory located in [...]and of the waters and areas adjacent to it and of the

port.”

“To grant each, besides the statue or bust, half the tax received from the exploitation of the sea in two years”.

There was a tower and a small port within the disputed zone. It is possible that this maritime spot had a common use, but one of the two cities appropriated it for exploitation. The arbitration resolution also includes honours granted to two delegates of Tenos, in gratitude for their work. Such honours include the concession of half of a so-called θαλάσσιον τέλος, that is, of the canon for fishing rights, for 2 years.²⁷ The canon surely was very profitable, mainly thanks to the fishing of *purpura* molluscs.



Fig. 16.2. 11. Hierapytna; 12. Rhodes; 13. Praisio; 14. Stalai; 15. Koufonisi; 16. Caudos; 17. Gorthyn.

Treaty between Hierapytna and Rhodes

Hierapytna had public fishing sites on its coast, which is deduced from a treaty signed with Rhodes towards the end of the 3rd century BC, c. 205 (Fig. 16.2, nos 11–12).

Schmitt, *Staatsverträge* III 551, ll. 66–69:

“Εἰ δέ τις | κα τὰς ἀπὸ τοῦ δικαίου γινομένας ποθόδους ἐκ θαλάσσης | παραιρῆται Ἱεραπυτνίων ἢ τὰν καθεστακυῖαν δαμοκρατίαν | παρὰ Ἱεραπυτνίοις καταλύη καὶ συμμαχίαν μεταπέμπωνται Ἱεραπύτνιοι, ἀποστελλόντων Ῥόδιοι Ἱεραπυτνίοις τριήρεις δύο.”

“And if someone takes there venues legally obtained from the sea away from the Hierapytnians, or destroys democracy among the Hierapytnians, and the Hierapytnians demand the implementation of the alliance, the Rhodians shall send two triremes in aid of the Hierapytnians”.

One of the pact’s clauses (l. 66–70) states that the Rhodians would send two triremes in aid of the Hierapytnians if someone wanted to deprive them of the

revenues from their exploitation of the sea. The προσόδοι ἐκ θαλάσσης that the Hierapytnians are protecting with this clause are the rights of fishing on their own coasts.²⁸ This wealth could be threatened by neighbouring cities' desire to annex it, and even by corsair pirates supported by other Cretan *poleis*.²⁹ Very possibly, the Hierapytnians must have had to defend the fishing spots in previous moments of their history. The clause in the treaty would be mainly aimed at preventing another Cretan *polis* from attempting to occupy a Hierapytnian fishing site and starting its own exploitation of it. That would cause a serious incident, which could lead to a war. The Rhodians committed themselves to come immediately to the rescue with two triremes in order to restore the original status in the fishing areas belonging to Hierapytna.³⁰

Praisio and Stalai

Another Cretan sample of the emerging model is the agreement signed between the Cretan cities of Praisio and Stalai (Fig. 16.2, nos 13–14) at the beginning of the 3rd century BC. The decree established that both signatories would forever share equally a series of tithes that the Stalitians would raise. Among these tithes, there is mention of those obtained from the shellfish purple.³¹ This tithe was a percentage tax on commercial transactions involving the sale of shellfish purple.

*Syll.*³² 524, ll. 4–8:

“ἐπὶ τοῖσδε ἔδωκαν Πραΐσιοι Σταλίταις τὰν χ|ώραν καὶ τὰν πόλιν καὶ νάσους τὰς καὶ νῦν ἔχον | [τικ]αὶ ἐλλυμενίου καὶ πορφύρας καὶ ἰχθύων δεκά | [τα]ς, τούτων πάντων τὸ ἡμισσον, ἰχθύωμ μὲν καθάπερ | [κ]αὶ πρότερον.”

“By these terms, the Praisionians turned over to the Stalitai the territory and the city and the islands, which they already have now, as well as the tithe of the revenues from the port and of the shellfish purple and of the fishing, of all this one-half (in the case of fishing as they did in the past)”.

According to a credible reconstruction, relations between the two communities may have experienced the following process: Stalai would originally have been an independent *polis* conquered by the city of Praisio in the 4th century BC. The people of Praisio kept the power and revenue of the city and territory, while leaving the islands and the sea in possession of the Stalitians (Praisio was an inland city of Crete and found the control of those coastal areas difficult).³² However, in exchange for the usufruct, Stalai was forced to give Praisio half of the tithe on port rights, as well as on the shellfish purple and on the fishing. From this we deduce that the city of Stalai perceived an important tax rate on the fishing of shellfish before being conquered by the Praisians and falling under its control; because of its high yield, half of that rate – which previously it preserved wholly for itself – was seized by Praisio as war booty.

Caudos and Gortyn

This case offers special interest. The small island of Caudos had fallen under the rule of Gortyn after a war (end of 3rd century BC; Fig. 16.2, nos 16–17). The Gortynians agreed to grant Caudos a special statute.

IC IV 184, ll. 8–12 [= Chaniotis Nr. 69]; (end of the 3rd century BC):

“φέρεν δὲ τὸνς ἐν Καυδοῖ φοικίοντανς τῶν γιννομένων πάντων ἐν ταῖ χώραι | δεκάταν καθὼς οἱ Γορτύνιοι, πλὰν θνατῶν καὶ τῶν λιμένων τᾶς | προσόδω καὶ λαχάνων· ταῦτα δ’ αὐτοῖ ἐχόντων. ἄλῶν δὲ διδόντων χιλιάδας πέντε κατ’ ἐνιαυτόν.”

“The people of Caudos will turn over, as the Gortynians do, a tenth part of all products obtained in their territory, except animals, the revenues from ports, and vegetables from the country. They can keep all that for themselves. From the salt, they shall turn over five thousand (measures) annually”.

The statute imposed on the inhabitants of the island the obligation to give a tithe from everything the territory produced; however, among other concessions, it permitted them to retain the so-called port revenues (προσόδοι τῶν λιμένων). That expression implies not so much the idea of a commercial port, but rather the reality of the different λιμένες operating on the island for the exploitation of marine resources.³³ From the Gortynians, the inhabitants of Caudos obtained a convenient grant: they would not have to give the tithe from revenues derived from sea products. Consequently, we may suspect that the always valuable shellfish purple did not reach large capture volumes at the site.

The importance of shellfish purple procurement in Crete since Minoan times is well known. It was one of the products from the sea that obtained higher revenues for many island cities and for others from Asia Minor. Shellfish capture took place off a platform adjacent to the littoral.

Other cases

Similarly, there are other cases that, indirectly, tell us about the vigilance exercised to defend shellfish purple from the appetite of other *poleis*. We know that the best areas on the island of Delos for shellfish purple fishing were part of Apollo’s domains, and they were leased to private individuals for periods of ten years (Fig. 16.1, no. 10). Ten years was also the duration for leases of public goods in Athens.³⁴ This rule was prescribed in Delos by the *ἱερὰ συγγραφή*, which was a general ordinance to regulate leases and other legal procedures.³⁵ The existence of this regulation may be presumed from the time of the Athens protectorate over Delos (5th century BC), which always monitored the integrity of the island with its strong navy.

Some studies on the *phoros* paid to the Delian-Attic maritime league by several coastal cities of Asia Minor in the 5th century are based on calculations of the economic importance of fishing revenues.³⁶ The *phoros* is calculated according to the resources of each city, and we know that the main wealth of

some states was shellfish purple.

This would mean that contributions to the league by Abydos, Lampsacus, Parion and Sigeion came out of state revenues obtained from these activities.³⁷ We can also deduce that the entrance of those cities into the league was primarily to defend such benefits from the ambitions of other *poleis* and from the demands of the Persians. The warships of the maritime confederation had to protect them if they were attacked. The need to defend the mollusk fishing grounds was, without doubt, before the Hellenistic era.

As a last point, in a Hellenistic decree from Iasos (Caria; Fig. 16.3, no. 23), the merits are weighed of a military leader who guaranteed the security of the sailors and others who worked on the water. The text recalls how that commander was able to prevent hostile forces from entering Iasos through the πόρος (that is, down the narrow straight that led into the gulf) and harming the people who were working there. The detail corroborates up to what point the fishing resources were a source of much appreciated wealth and how, in the face of hostility from neighboring *poleis*, the city took care to preserve them.

Final considerations

State revenues generated from the activities of the observation posts and the fishing ports, as well as from the sale of molluscs and fish, were a significant source of wealth. Greek cities were constantly concerned with the protection and defense of these προσόδοι, which can be described either as προσόδοι τῶν λιμένων or as προσόδοι ἐκ θαλάσσης. Many *poleis* had well-organised territorial mechanisms for fishing shellfish purple. According to the solution that was developed, the state becomes owner of the place construed as a fishing ground; in such cases, coastal land ownership carries with it the ownership of the adjacent maritime strip. This determines a water right. The corresponding maritime space assigned to the fishing ground was delimited quite arbitrarily, although known by all. To the extent possible, it would have boundary stones. The solution was not problematic for the reserves located in uncontroversial territory, but it raised difficulties when the fishery was in an area of the χώρα next to that of another *polis* or in uninhabited islets (including Kouphonisi?). Certain fisheries were part-owned by two or more *poleis*, which would establish a formula for exercising the co-ownership. Most likely, they would take annual turns in the possession of the place, or would distribute the fishing dates by months. Several arbitrations aimed at settling territorial issues arising from disputes over the right to exploit a λιμήν (Hermione-Epidaurus, Zarax-Epidaurus, Troezen-Arsinoe), are evidence of the instability of the titles issued to reserve the exercise of an exclusive right to fish. When these rights were challenged by neighbouring states wars and military occupations took place.



Fig. 16.3. 18. Miletos; 19. Abydos; 20. Lampsacos; 21. Parion; 22. Sigeio n; 23.

Arbitrations are only a brief sample of warlike incidents concluded with a pact; but, no doubt, there were many other cases in Greek history, which ended with the loss of the fisheries for the benefit of the strongest *polis*. We find an unequivocal reflection of these threats of war, which were clearly perceived by all the cities of Crete that exploited the sea (and especially shellfish purple), in several alliance treaties drafted between some of them. Indeed, a clause appears in some agreements' text that foresees the mutual obligation to come to the aid of the other party in the event an outside enemy tries to forcibly strip it of its ports or islands (λιμένας καταλαμβάνειν, λιμένας ἐφέρπειν, νάσους καταλαμβάνειν, νάσους και λιμένας καταλαμβάνειν).³⁸ In addition to the resources obtained through fishing, it is very likely that many of the ports included in the wording of the treaty, as well as the majority of the islands over which it exercised control (ancestral or provisional), were also provided with considerable economic benefits derived from the seasonal capture of shellfish purple molluscs, sponges, corals, dye seaweed, etc. It was a very powerful motive for covering the possibility of an attack and anticipating military help from an ally when their sources of wealth were put in danger.

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Abbreviations

DS	C. Daremberg, E. Saglio and E. Pottier (eds), <i>Dictionnaire des Antiquités Grecques et Romaines</i> . Paris, 1877–1919.
IC IV	M. Guarducci, <i>Inscriptiones Creticae</i> . Vol. 4. <i>Tituli Gortynii</i> . Rome, 1950.
IG IV ² 1	F. Hiller von Gaertringen (ed.), <i>Inscriptiones graecae</i> , IV. <i>Inscriptiones Argolidis</i> . Fasc. 1. <i>Inscriptiones Epidauri</i> . 2nd edition, Berlin, 1929.
PG	Migne. <i>Patrologia Graeca</i>
SEG	<i>Supplementum epigraphicum graecum</i> , ed. A. G. Woodhead. Leiden.
Syll. ³	W. Dittenberger, <i>Sylloge inscriptionum</i>

graecarum I–IV (3rd edition: coeds. F. Hiller von Gaertringen, J. Kirchner, H. R. Pomtow, E. Ziebarth), Leipzig 1915–1924.

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1Cristofori 2001, 1–4.

2Mylona 2008, 11–15.

3Bekker-Nielsen 2005; Alfaro and Mylona 2014, 151–167.

4Born 1937.

5Alfaro and Costa 2008; Alfaro *et al.* 2010, 109–119.

6For the vegetal dyes (especially *fucus*), used by women for doing a “vegetal purple” colour, very cheaper, *cf.* Martínez 2014.

7Alfaro 2011, 38–40.

8Alfaro 2011, 47.

9Arist., *HA* V, 547a, 5–11.

10 Arist., *HA* V, 546b; Plin., *NH* IX, 125 and 133.

11 Ruscillo 2005; 2006, 808–817.

12 Plin., *NH* IX, 124–141 (especially 133).

13 Plin., *NH* IX, 133–135.

14 Plin., *NH* IX, 133: *cui addi salem necessarium, sextarios ferme centenas in libras*. Salt represented 1–2% weight of the dye-liquid; *IG* IV² 2, 38–40 (see below).

15 You must have white lead, as Pliny advises (*NH* IX, 133: *feruere in plumbo*), which is needed in making the cauldrons in which the dye is prepared. This occurs by chance in Ibiza (Mina de S’Argentera).

16 Alfaro *et al.* 2010; we are proposing this solution for the purple workshops

of a little island like Ibiza, whose high dye production, sparsely and poorly populated and the presence of a *procurator baphii* in the era of the Later Empire (controlling the so-called *Baphium* of the Balearic Islands, which is spoken of in the *Notitia Dignitatum* (cf. Seeck 1876, *ND occ.* I, 105; III, 6–13; IX, 71 and XXI, 15), are clear indicators that the local population did not consume on its own the apparently large quantity of dye that came from the coastal workshops.

17 Fernández Nieto 2002, 231–255; Mylona 2008, 49, fig. 5.6.

18 What in Ibiza are called “calas”. The installations of the workshops for dye production in these small natural ports have an identical position on this island: they are almost all in the eastern part, a transit area for tuna, and the workshop is habitually located on the right-hand side; we do not know exactly why.

19 About these two expressions see Fernández Nieto 2003, 221–227.

20 Lafaye 1910, 489; Bekker-Nielsen 2005; Alfaro and Costa 2008, 198 s.; Mylona 2008.

21 Hor., *Od.* II, 18, 7–8; Plin., *NH* IX, 127; XXI, 45; XXXV, 45 (*pretiosissima purpura*); Paus., III, 21, 6 (κόχλους δὲ ἐς βαφὴν παρέχεται τὰ ἐπιθαλάσσια τῆς Λακωνικῆς ἐπιτηδειοτάτας); Ath., *Deip.*, 198 f.

22 Fernández Nieto 2007, 47; 52; 2011, 275.

23 Ager 1996, 381–385, nr. 138; Magnetto 1997, 260, n. 5.

24 Wilhelm 1948, 57–59.

25 Alciph., III 10, 3–4.

26 Magnetto 1997, 405–416.

27 Ager 1996, 221–223, nr. 80. On the interpretation of θαλάσσιον, see Fernández Nieto 2011, 274 f. For Wilhelm 1951, 60–67, this canon would be the ἐλλυμένιον, but according to Vélissaropoulos 1980, 218, it could refer to a tax rate on navigation (ναυκληρία).

28 Another interpretation in Vélissaropoulos 1980, 205, n. 3, as she thinks that these προσόδοι could be tax rates on maritime commerce or perhaps income obtained from keeping as property the remains from shipwrecks.

29 Kreuter 1992, 70 f.

30 Guizzi 2001, 394–397; Fernández Nieto 2007, 48.

31 Other cities in south-east Crete (Hyerapithna and Itanos) were very interested in the island of Kouphonisi (ancient Leuké for some). *Vid.* Coutsinas and Guy, in press. We must thank Nadia Coutsinas and Max Guy for the generous information they provided us regarding the island of Kouphonisi (Fig. 16.2 , no. 15; very possibly one of the islands mentioned in the inscription that we studied as a fishing place for the inhabitants of Stalai). Likewise, our recognition of their kind offer that we collaborate jointly in the direct study of the island and its importance as a producer of purple dye during the Ptolemaic era. Unfortunately, the project could not be carried out for various reasons (its

excessive cost and the difficulty of the undertaking due to the characteristics of the terrain to be surveyed).

32 Gschnitzer 1975, 79–102; Chaniotis 1996, 383–393.

33 On the concept and reality of the λιμένας in the territory of a Greek *polis*, see Fernández Nieto 2007, 50–52.

34 Arist., *Athen. Pol.*, 48, 4.

35 Durrbach 1919; Ziebarth 1926; Charre and Couillout-Le Dinahet 1999.

36 Tenger 1995.

37 Exploitation of shellfish purple in Lampsacos (*Vita S. Parthenii* 9 [PG 114, 1357]) and Sigeion (Arist., *H. A.* V, 15, 557a 5–6; Ath., *Deipn.*, 88 f).

38 This clause concerning the special protection of ports and islands appears in the following treaties: Treaty of Alliance between Gortyn and Lappa (end of the 3rd century BC) (Chaniotis 31, lines 12 s.); Alliance between Eleutherna and Lato, beginning of the 2nd century BC (Chaniotis 37, lines 15 s.; 19); Alliance between Aptera and Eleutherna, early 2nd century BC (Chaniotis 38, lines 11; 16); Treaty for Alliance and peace between Lato and Oluntus from the end of the 2nd century BC (Chaniotis 61, A lines 5 s.; 9; 79 s.; B 18).

***Purpurarii* in the Western Mediterranean**

Benedict J. Lowe

Introduction

The goal of this paper is to discuss the profession of *Purpurarius* and their role in the trading of purple dye. Epigraphic evidence for *Purpurarii* is scarce and professions in the provinces have only recently begun to receive the attention that they deserve. The fullest ancient account of purple-dye processing is found in Pliny (NH 9.62.133). Recent excavations have done much to clarify the production of purple dye, but areas of debate remain. This paper reconsiders the evidence of dyeing installations together with epigraphic evidence for *purpurarii* in order to clarify their role and the scale and character of the trade of purple dye in the Western Mediterranean. Evidence for dye production takes several forms: the remains of the crushed shells, the processing areas where the shells would have been broken up, the containers or vats in which the dye glands were macerated in salt, residue of the materials used to maintain the alkalinity of the mixture such as the lime, urine and ash found in a vat in a dye-shop in Barcelona, the heating facilities and containers in which the dye-salt mixture was heated, and the proximity of salt sources and textile workshops. Similarities with the processing of *salsamentum* and fish sauces has led to the suggestion that dyeing took place as an ancillary to fish salting with the same installations and labour force.

Recent years have seen a number of important studies on Purple Dye that have done much to clarify its production. The focus of this paper is to turn our attention to the other end of the process and to look at the role of *purpurarii* as distributors or sellers. This aspect has attracted far less attention – not surprisingly considering the paucity of evidence.

In the past *Purpurarii* have been defined as engaged both in the preparation of purple dye as well as its commercialisation.¹ The stele of the *purpurarius* C. Pupius Amicus is decorated with the accoutrements of his profession: a set of scales to weigh the skeins of dyed fabric, a *regula* to measure the fabric, an *unguentarium* and two bottles.² It would appear from the range of items depicted that Amicus was engaged in the sale of dyed fabric. Several of the same elements decorate the tombstone of M. Satelliis Marcellus (Fig. 17.1) a *purpurarius* from Galeata (Forlì): on the left a set of scales and a jug, as well as *fascēs*; the right is less well preserved but may include a vessel and a skein of

cloth.³

The bottles are more problematic: on exposure to the atmosphere the dye oxidises rendering it unusable.⁴ The solution was to either dye the fabric immediately before oxidation occurred or to use a dissolving agent. According to Vitruvius honey could be added (7.13.3):

“id autem propter salsuginum cito fit sticulosum, nisi mel habeat circa fustum”.

“on account of its saltiness, it soon dries up unless it has honey poured over it”.⁵

The bottles may signify that Amicus sold quantities of dye such as this honey-dye mixture, or that he was able to do a limited quantity of dyeing on his own premises.

Several sources refer to the trade of purple dyed products: an ostraca from Egypt dated to 3 September AD 42 is a receipt for eight pouches of purple. It is not clear if this is Murex purple or cheaper natural purple dyes.⁶ The Tariff of Zarai of AD 202 gives a rate of only 1 denarius for a purple cloak.⁷ This is in marked contrast to the prices given by the Elder Pliny (9.63.137): in the 1st century BC a pound of *purpura* cost 100 denarii, whilst Tyrian Purple could not be brought for less than 1000 denarii per pound. The cheaper price probably represents cheaper natural dyes rather than Murex purple. The Edict of Maximum Prices gives a range of prices: the highest quality purple on silk cost 150,000 denarii per pound, robes of Tyrian Purple costing upwards of 10,000 denarii, whilst natural purples could cost as little as 1000 denarii (29.1–49). Inscriptions refer to several *purpurarii* engaged in trade: P. Murrius Zetus identifies himself as a *Mercator purpurarius*.⁸ An inscription from Rheims records Victorius Regulus (Fig. 17.2) as a *Neg(otiatori) Duro(cortoro) Purpurario*.⁹ The *purpurarius* Diocles named in an inscription from Córdoba may also have been engaged in trade.¹⁰ Similarly Baebia Veneria a possible *purpuraria* from Cádiz.¹¹ Strabo (3.2.1) stresses the importance of Córdoba and Cádiz as commercial centres due to their access to the sea and to the Río Guadalquivir.

A fragment of a funerary monument from the Via Praenestina records a freedman, D. Veturius Atticus, a *purpurarius* from the *Vicus Iugarius* – the area from the Capitol to the Porta Carmentalis. Veturius Atticus may be related to the freedwoman named on a marble statue base on the Via Appia in honour of the freedman L. Plutius Eros, a *purpurarius* in the *Vicus Tuscus*. All three individuals are freed slaves: Eros and Auge of L. Plutius and Attica of two Caii Veturii. The relationship of the three is not explained but we seem to have a professional relationship based on the operation of an *officina*.¹² An inscription commissioned by a freedwoman Veturia Fedra identifies her as a *purpuraria Marianeis*. The reconstruction of *purpuraria* is uncertain and may read *purpurari* in which case all the individuals named were engaged in the distribution of purple dyed cloth in the *Vicus Marianeis* – probably the vicinity of the Marian

monuments on the Esquiline. The *purpurarii* named are freedmen and the identification of D. Veturius Diogenes as *patronus* may suggest that we are looking at *liberti* operating workshops on his behalf. Whilst Veturia Fedra seems to have been married to Nicepor – *vixit mecum annos viginti* – she avoids explicit use of the term *coniunx* (spouse) in favour of calling him her *conlibertus* stressing professional rather than familial relations.¹³

A similar relationship may lie behind the list of freedwomen of A. Vicirius who were *purpurariae*.¹⁴ Similarly several Pullii are named on an inscription from Aquileia including the freedmen M. Pullius Fusco and M. Pullius Hormus identified as *purpurarii*.¹⁵ An inscription from Capua was erected by an unidentified patron and a freedwoman, Fausta, in honour of the freedman C. Minatius Philodamus.¹⁶ Gregori has suggested that specific families were associated with the trading of purple: Clodii, Livii, Modii, Plitii, Venonii, Vetirii and Vicirii.¹⁷

The stress on professional relations suggests that these freedmen operated *officinae* or *tabernae purpurariae*. Suetonius refers to the emperor Nero closing down the shops of the purple dye dealers presumably in Rome (6.32.3):

“Et cum interdixisset usum amethystine ac Tyrii coloris summisissetque qui nundinarum die pauculas uncias venderet, praeclusit cunctos negotiatores.”

“Having forbidden the use of amethystine or Tyrian purple dyes, he secretly sent a man to sell a few ounces on a market day and then closed the shops of all the dealers”.

According to the *Digest* a father could bequeath his *taberna purpuraria* to his son together with his slaves and the purple that he had on the day of his death (32.91.2):

“Pater filio tabernam purpurariam cum servis institutoribus et purpuris, quae in diem mortis eius ibi fuerunt, legavit, neque pretia purpurae condita neque debita neque reliqua legato contineri placuit.”



Fig. 17.1. The tombstone of M. Satellius Marcellus (courtesy of the Museo Mambrini di Pianetto (Galeata)).

Some trades were concentrated in specific areas, for example, tanners in Trastevere, potters on the Janiculum and Vatican.¹⁸ Access to supplies of raw materials as well as particular markets were important considerations in locating a business. Several of the inscriptions identify specific locations: the Vicus Iugarius, the Vicus Tuscus, the Vicus Marianeis, an unidentified *purpurarius* was based in Trastevere, and a fragmentary inscription identifies P. Clodius Philonicus as a *purpurarius de vico*.¹⁹ The sample is too small to draw any definite conclusions but there does not appear to have been a concentration in a particular area.

As well as selling through shops or workshops, *purpurarii* could also be found elsewhere: Martial (10.87.9–10) refers to a seller of purple cloaks in the Horrea Agrippiana. His presence may have been prompted by several *vestiarii* in the

vicinity: C. Iulius Lucifer a *vestiarius de horreis Agrippianis*, M. Livius Hermeros, P. Fannius Apollophanes a *vestiarius de vico Tusco*.²⁰ *Purpurarii* also operated through periodic markets – *nundinae* – that traditionally took place every 8 days. Suetonius (*Nero* 6.32.3) refers to a man selling purple dye “*nundinarum die*” presumably in Rome.

Several individuals rose to positions of importance: an inscription from Augsburg records a *negotiator artis purpuriae* Tiberius Claudius Euphrates who held the office of *sevir*.²¹ The *purpurarius* C. Marcilius Eros is named as a *quinquevir* on an inscription found near Monte Prandone.²² Cn. Haius Doryphorus was an *augustalis* in Puteoli.²³ L. Modius Philomusus is named as a magistrate on an inscription from Rome.²⁴ The L Bennius accompanying Philomusus in the inscription may be connected to the L Bennius named as a *purpurarius* on an inscription from Porta Maggiore.²⁵ The freedman P. Servius Numeri is listed as a *Magister Castori et Polluci et Mercurio Felicio* at Capua.²⁶ M. Satellius Marcellus referred to earlier held the office of *sexvir* and celebrated his status with the depiction of his *fasces*.²⁷ The epitaph of P. Murrius Zetus identifies him as a man of great importance who was flourishing greatly: “*quom plurimi fui et florebam maxime*.”²⁸

The impression given by these inscriptions is of a complex and profitable profession: the popularity of purple is reflected in Martial’s comment about Augustus’ use of the colour to keep with fashion – “*ut me populus Romanus dicat bene cultum*” (2.4.14); but the lack of organisation in the form of *collegia* or guilds is striking. Some families such as the Veturii, Vicirii and Pullii seem to have employed several freedmen although individual freedmen also occur frequently. The operation of *tabernae purpurariae* suggests that *purpurarii* could engage in both small-scale production or the repair of fabrics as well as trade. Their presence at markets and as *institutores* implies a more itinerant trade alongside the use of fixed locations.

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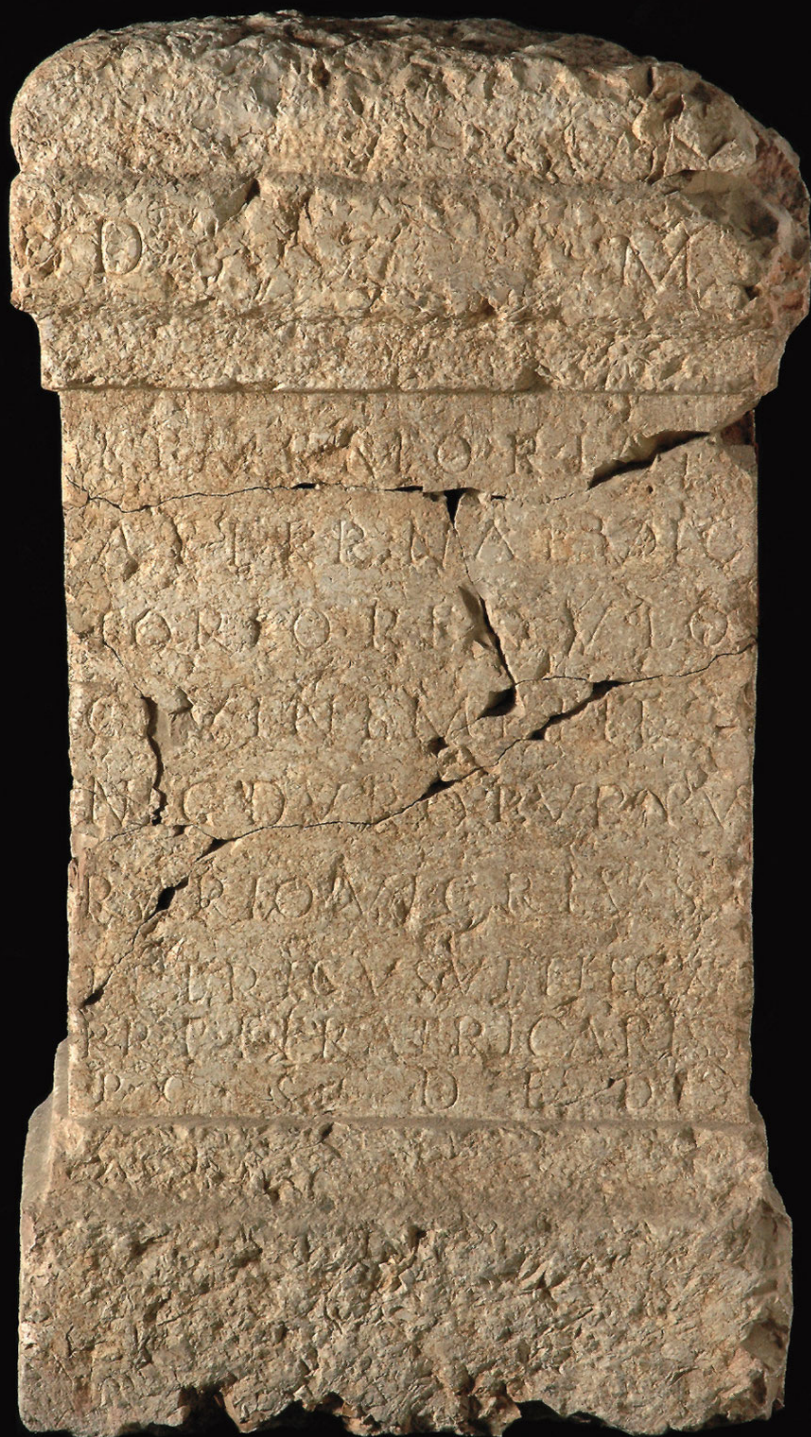


Fig. 17.2. Tombstone of Victorius Regulus (photo: C. Thioc and J.-M. Degueule,

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1Loane 1938, 191; Gregori 1994, 740. The lack of *tinctorum* and *infectorum* in Rome is striking, Loane suggests that they may have adopted the more prestigious term of *pupurarius* (1938, 76). Hughes 2007, 87 has suggested that *pupurarii* also sold other varieties of purple goods such as the meat from the murex shell.

2CIL XI.1069a; Macheboeuf 2004, 140–142; Frova *et al.* 1965, 152; Zimmer 1982, 130–131.

3CIL XI.6604; Zimmer 1982, 131–132.

4Lowe 2004, 46; Edmonds 2000, 18.

5Cf. Macheboeuf 2004, 142. Plut. *Alex.* 36 refers to Purple from Hermione that was 190 years old.

6O. Petrie 264. An edict of AD 383 distinguishes *sacer murex* and *publicus murex* (Cod. Theod. 10.20.18), cf also SHA *Pertinax* 8.2. On other types of Purple dye, cf. Vitruvius 7.14.1; Theophrastus 4.6.5; Pliny *NH* 16.77, 35.26, 44–45; Strabo 13.4.14. Faded Alexandrian purple garments are amongst the items listed in a pawnbroker's receipt from Egypt, P. Mich. Inv. 3136, Husselman 1961, 256–265.

7CIL VIII.4508.

8AE 1972, 74.

9AE 1982, 709; Wierschowski 2001, 45–46.

10 CIL II.2235.

11 CIL II.1743. A funerary stele from Córdoba reads: “[] /Purpuria/[] annoru]m(?)/[h(ic) s(ita) e(st)]/s(it) t(ibi) t(erra) l(evis)” (CIL II.2321).

12 On the relationship, cf. Treggiari 1979, 71–72.

13 Dixon 2011, 121; Joshel 1992, 136.

14 CIL VI.9846.

15 CIL V.1044.

16 CIL X.3973.

17 1994, 740.

18 Tanners: Martial 6.93.4; Juvenal 14.202–204. Potters: Martial 1.18.2, 12.48.14; Juvenal 6.344. Professions gave their names to particular parts of the city: for example the *Vicus Lorarius* (Street of the Harness-makers (CIL VI.9796); *Vicus Materiarius* (Street of the Carpenters) (CIL VI.975); *Scalae Anulariae* (Stairs of the ring-makers) (Suetonius, *Aug.* 72).

19 AE 1991, 264; CIL VI.9848.

20 CIL VI.9972; CIL XIV.3958; CIL VI.9976. *Vestarii* are found in other horrea

also: T Aquilius Pelorus was a *vestiario de horreis Volusianis* (CIL VI.9973).

[21](#) CIL III.5824.

[22](#) CIL IX.5276.

[23](#) CIL X.540.

[24](#) CIL VI.32454.

[25](#) AE 1994, 283; Grigori 1994, 740.

[26](#) CIL I.2947.

[27](#) CIL XI.6604; Zimmer 1982, 131–132.

[28](#) AE 1972, 74.